

# Vulcan



AEROGUIDE **6**

Avro Vulcan B Mk 2/Mk 2K



The date 31 March 1984 marked the end of an era for the Royal Air Force, for it was on that day that No 50 Sqn, the last unit to operate the Avro Vulcan, disbanded. The RAF's association with that majestic aircraft – an association which spanned more than a quarter of a century – has thus finally ended, and only twenty or so Victor tankers remain as the last reminders of Britain's formidable 'V-bomber' force of the late 1950s and 1960s.

The retirement of the Vulcan has also, officially, signalled the relinquishment of the RAF's capability in the field of long-range strategic bombing, a capability that had its origins in the 'bloody paralyzers' of World War I, was nurtured and developed through the 1920s and 1930s, was unleashed to great effect during World War II, and was called upon as recently as 1982. It remains to be seen whether its loss will be regretted.

This volume shows Vulcans as they appeared during their final weeks of front-line service, when No 50 Sqn was equipped with five tankers plus a couple of standard B Mk 2s. The tankers, designated B Mk 2K (though frequently referred to as Vulcan K.2), form the principal theme of AEROGUIDE 6, but for all practical purposes these are externally distinguishable from the B.2 only by the presence of the refuelling 'skip' beneath the tail fairing and the absence of the long cooling intake from the starboard side nearby.

The size of the Vulcan has meant that it has not been possible to provide 1/72 scale colour plans in this volume, and so 1/144 – another 'standard' scale, and one which model makers will recognise – has been selected. Even this scale has proven tight, and although the drawings are still, from the point of view of page layout aesthetics, too large, the practical advantages of 1/144 could not be resisted!

For this volume, the publishers acknowledge with gratitude the assistance given by the Royal Air Force, in particular by Flt Lt Michael Fogarty, CRO at RAF Waddington; Sqn Ldr Ron Hellen, No 50 Sqn; and Cpl Ray Nightingale, No 50 Sqn. Uncredited photos throughout the following pages were taken by kind permission of the Officer Commanding, RAF Waddington, and are copyright of the publishers. Thanks are also due to Chris Shepherd, RAF Strike Command HQ; Harry Holmes, British Aerospace, Woodford; Brian Petty, Martin-Baker Aircraft Co Ltd; Dick Ward; and Bob Downey.

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**Front cover illustration:** A Vulcan B Mk 2K of No 50 Sqn, RAF Waddington, February 1984

**Back cover plate:** Vulcan B Mk 2, 'Black Buck 1', Operation 'Corporate', May 1982

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# INTRODUCTION

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The closing years of World War II witnessed the introduction of two revolutionary technologies to the concept of military air power: the turbojet and the atomic bomb. By the time hostilities were finally brought to a close, it had become clear that henceforth the strategic bomber would look very different from the Lancasters and Halifaxes which were responsible for conducting the Royal Air Force's offensive against Germany and would moreover be called upon to carry weapons thousands of times more destructive. The nuclear role, it was perceived,

demanding an aircraft capable of flying great distances, at great speed and at high altitude in order to frustrate an enemy's attempts at interception (the aircraft would carry no defensive armament); furthermore, atomic weapons being weighty affairs in those early days, it would need to lift a 10,000lb bomb.

## DELTA PLANFORM

Such jolts to what had hitherto been a steady 30-year evolution in heavy bomber development provided aircraft manufacturers with exciting and

exacting opportunities for radical designs, and the two aircraft that would in due course be ordered into production in response to Specification B.35/46 of 1 January 1947 – the Handley Page HP.80 and the Avro Type 698 – were of startlingly different appearance from anything that had gone before. Christened Victor and Vulcan respectively, they would,

Below: The distinctive Vulcan shape is shown to advantage in this August 1961 photo of XH539, a B Mk 2, equipped with Blue Steel. *British Aerospace*







together with the less exotic Vickers Valiant, make up the celebrated 'V-bomber' force.

The speed (500kt cruise) required by B.35/46, the range (3000+ miles), the altitude (50,000ft), the maximum weight (100,000lb, restricted thus by existing military runway dimensions) and the 10,000lb bomb set out the broad parameters of the design: turbojet propulsion to provide the necessary thrust; a swept wing to overcome the compressibility problems afflicting near-sonic flight; sufficient fuel to enable the aircraft to reach its target and return home; a wing of

the required size to provide adequate lift at high altitudes; a pressurised compartment to enable the crew to survive at such heights; and a weapons bay of the necessary capacity. From an engineering viewpoint, these conditions in themselves posed no insuperable difficulties – the trick was to achieve something viable within the weight limits.

What eventually emerged from the Avro company was an aircraft that resembled a flying triangle – a delta planform of immense area in relation to its span. Aerodynamically, it was superbly 'clean' in order to offer minimum drag and thus extract the maximum possible performance; structurally, it was extremely strong, capable of withstanding the rigours imposed by the aircraft's role.

#### MARK 1, MARK 2

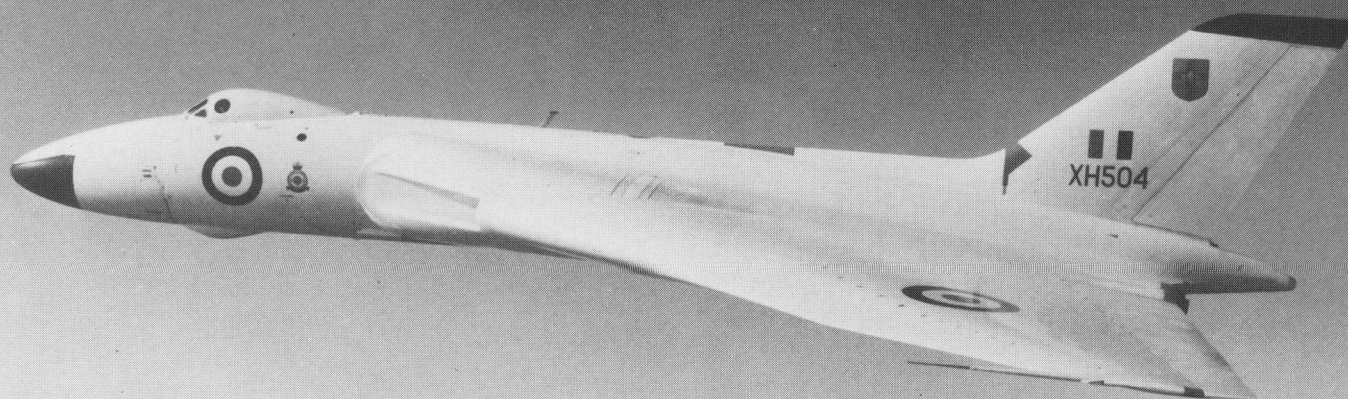
The Vulcan prototype flew for the first time on 30 August 1952, but it was not long before the pure delta planform

needed to be modified owing to buffeting problems experienced under certain conditions during high-speed, high-altitude flight. Hence the first production model, designated B Mk 1, introduced varying angles along the wing leading edge; in the B Mk 2, first flown in August 1958, this concept was developed further in the design of new, enlarged outer wing panels, principally to bring out the full benefits of the higher-rated Olympus powerplants that were now becoming available. Seventy B Mk 1s were ordered, but in the event 25 of these were modified to B Mk 2 standards whilst still on the lines; a further 64 new-build B.2s were procured from Avro.

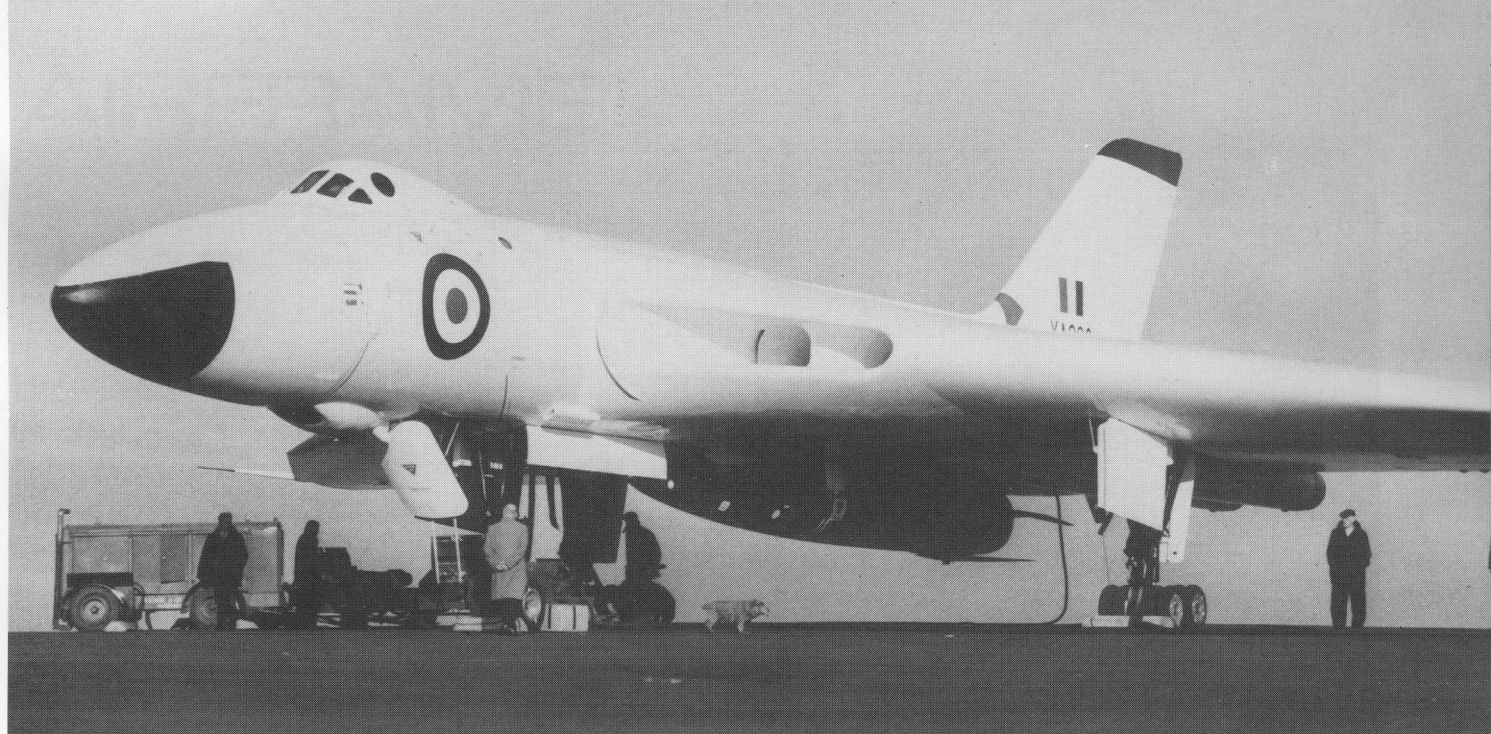
Front-line service entry for the delta-winged V-bomber came in May 1957 with the formation of No 83 Sqn (at Waddington), and Mk 1s also equipped Nos 101 (Finningley) and 617 (Scampton) Sqns; by the end of 1961 Nos 83 and 617 had re-equipped with Mk 2s and No 27 had re-formed with

Above: The Avro Type 698 – the Vulcan prototype – on a test flight in 1952. The original straight wing leading edges were modified on production aircraft to obviate buffeting. *British Aerospace*

Below: A No 230 Operational Conversion Unit Vulcan B Mk 1, showing original tail fairing shape. *British Aerospace*







the new variant at Scampton, 83's B.1s being transferred to No 44 Sqn and 617's going to make up No 50 Sqn. The following year Nos 9, 12 and 35 Sqs had re-formed with B Mk 2s at Coningsby, moving in late 1964 to Cottesmore.

#### CHANGING ROLES

The B Mk 1s had all been phased out of service by the late 1960s, although not before several modifications had been worked into the aircraft. Up-rated engines, an electronic counter-measures (ECM) package in a revised tail fairing and the installation of an inflight-refuelling system brought about a redesignation to B Mk 1A.

By 1964, three of the B.2 squadrons – Nos 27, 83 and 617 – had had their Vulcans modified to B Mk 2A standard in order to carry the Blue Steel missile, a 'stand-off' weapon produced to keep the British nuclear deterrent capability effective in the light of improving ground-launched anti-aircraft missile

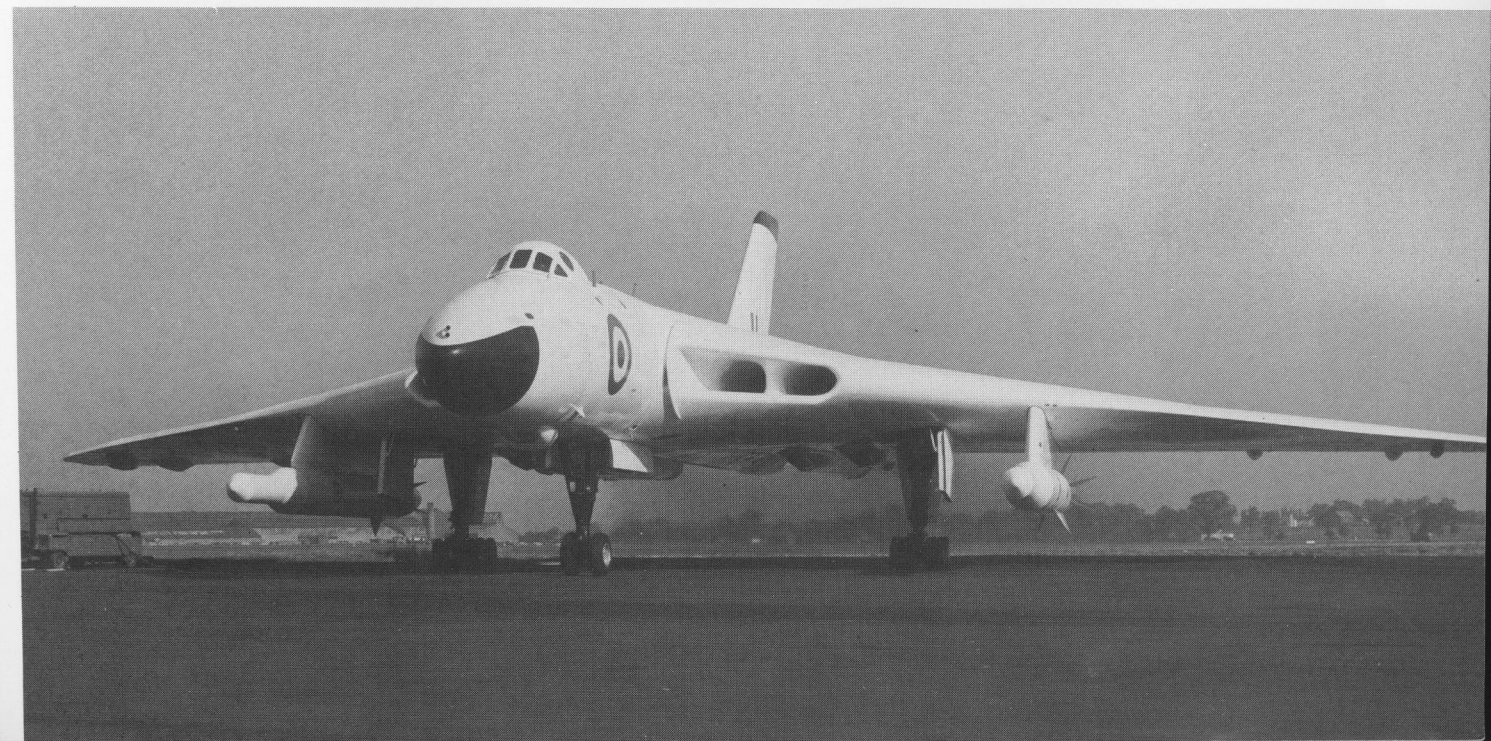
technology. The Royal Navy assumed responsibility for this capability in 1969 with the entry into operational service of the Polaris submarine-launched ballistic missile (SLBM), by which time the Vulcans, already switched to low-level operations rather than high-altitude attack in order to defeat – or, at least, reduce the value of – hostile ground-based radars, were ready for their new task as tactical nuclear bombers.

In the mid-1970s No 27 Sqn began to operate modified B Mk 2(MRR) maritime radar reconnaissance aircraft, but during 1981–82 the Vulcan squadrons were all expected to be disbanded in favour of re-equipment with Tornados (see AEROGUIDE 4). However, the South Atlantic War in the spring of 1982 brought about an abrupt change of plan, and the three units in being at that time – Nos 44, 50 and 101 Sqs, based at Waddington – were kept operational. Five Vulcans formed a 'pool' of aircraft re-equipped to under-

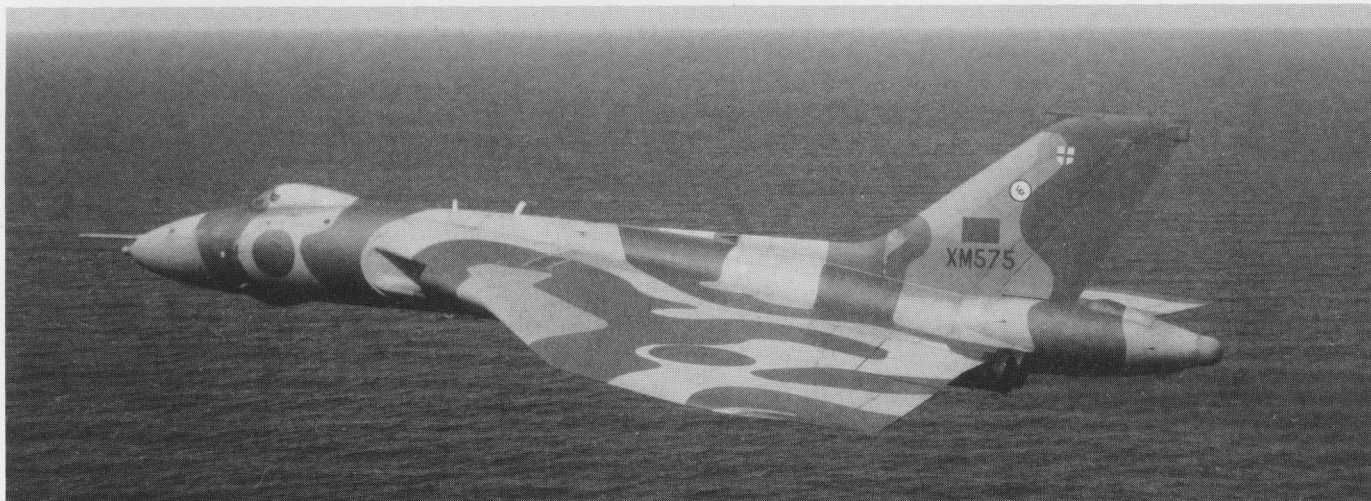
take conventional HE bombing and anti-radar attacks on the airfield at Port Stanley in the Falkland Islands in order to deny its use to the occupying Argentines, and thus it was that, in the late evening of its operational life, Avro's delta was flown in anger.

No 50 Sqn continued to fly its Vulcans up until March 1984, using six aircraft modified as inflight-refuelling tankers and redesignated B Mk 2K – not a role, certainly, that could have been seriously envisaged in the manufacturer's design offices back in 1947, but one that has emphasised the aircraft's durability and adaptability.

Above: B Mk 2 XA903 was engaged in trials with the Avro Blue Steel stand-off air-to-ground missile. *British Aerospace*  
Below: XH537 fitted with dummy Skybolt air-launched ballistic missiles, December 1961. The Skybolt programme was abandoned a year later, and none ever entered service. *British Aerospace*



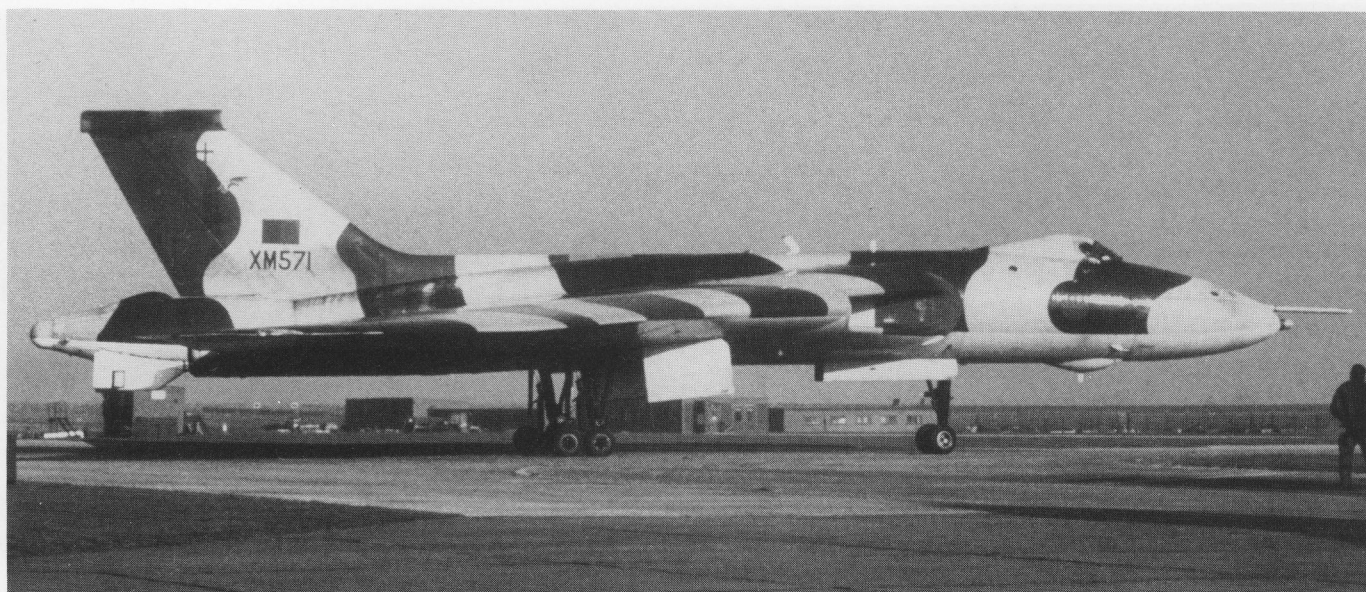




**Top:** With the switch to low-level operations, Vulcans relinquished their all-white finish in favour of camouflage, and terrain-following (TF) radar (nose 'thimble') and radar warning receiver

(RWR) antennas (fin top) were added. This is a No 44 Sqn aircraft, seen during the early 1980s. *British Aerospace*  
**Above:** Vulcan B Mk 2K, in No 101 Sqn markings, with inflight-refuelling hose

extended. *British Aerospace*  
**Below:** The same aircraft as that shown in the previous photograph, wearing the insignia of No 50 Sqn, February 1984. Note the glossy paint finish.





# AIRFRAME

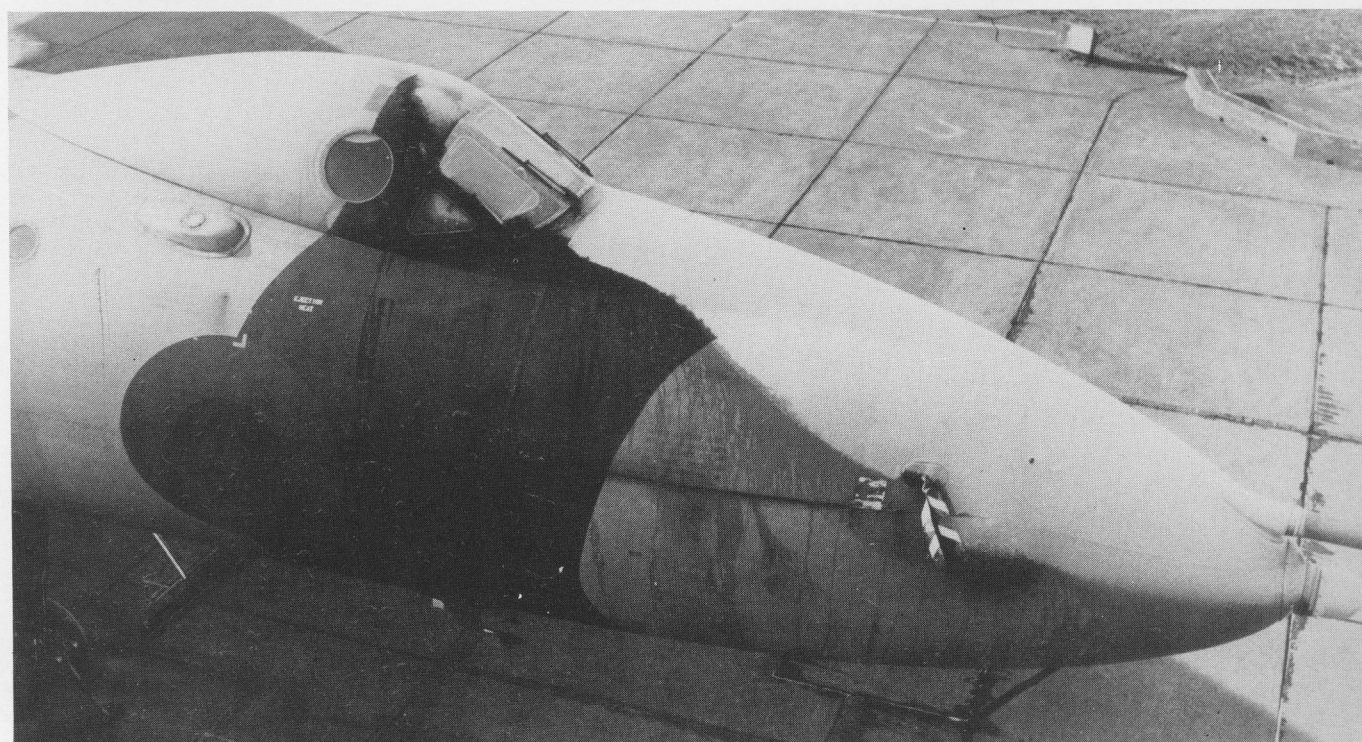
**Below:** The Falklands conflict in the spring of 1982 interrupted the scheduled phasing out of Vulcans from the Royal Air Force, and a batch of B Mk 2s were hastily readied for a series of raids on Port Stanley airfield. Modifications included re-converting bomb bays to accept conventional 1000lb bombs, reactivating the disused

inflight-refuelling system, manufacturing and fitting wing pylons for ECM pods and Shrike anti-radar missiles and, as shown here, repainting the undersurfaces of the aircraft Dark Sea Grey in keeping with the nocturnal visits planned for the aircraft. This photograph was taken in January 1983; the Vulcan immediately beyond that in the

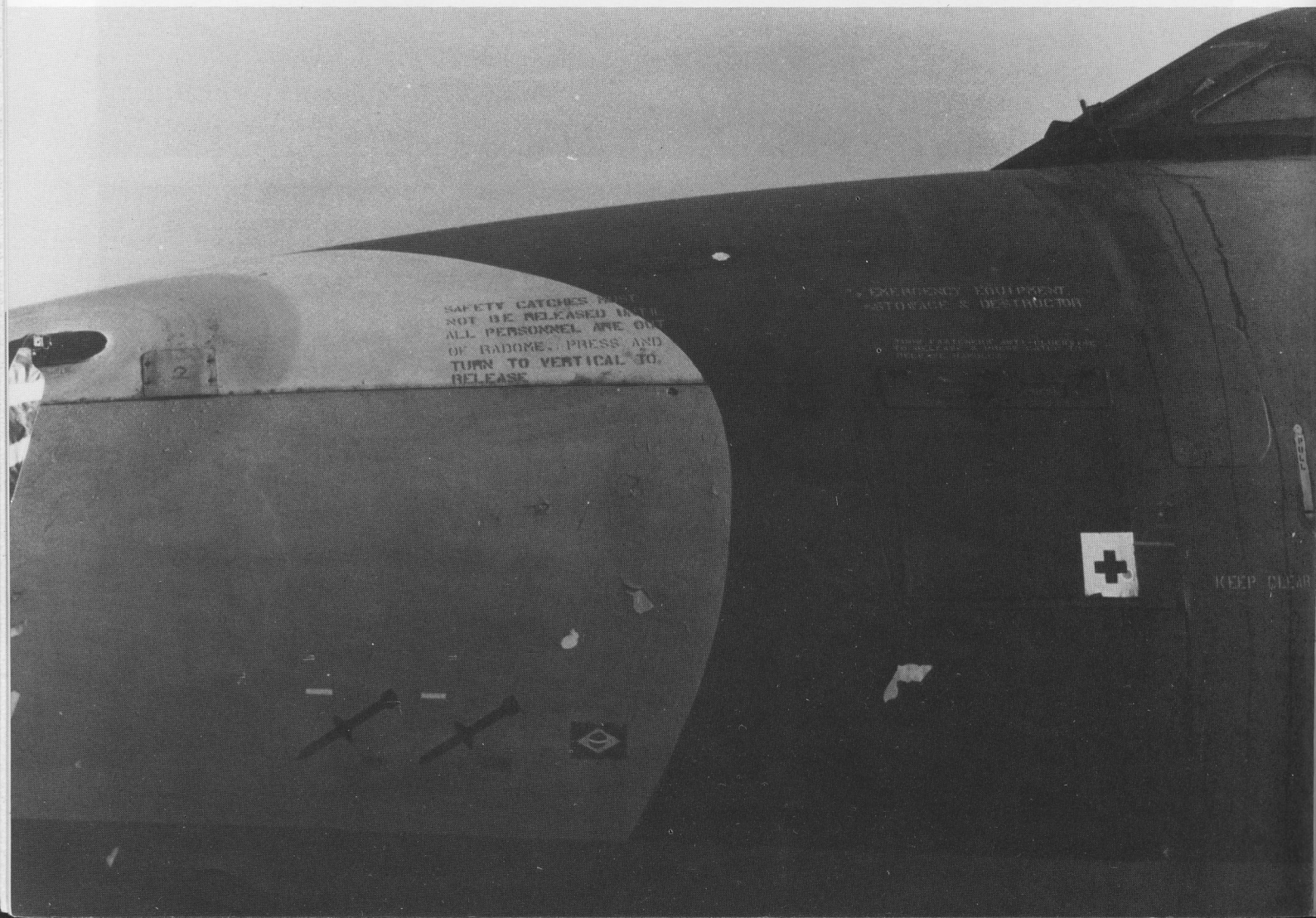
foreground is the famous XM607, hero of 'Black Buck 1', the 1 May strike.

*Richard L Ward*

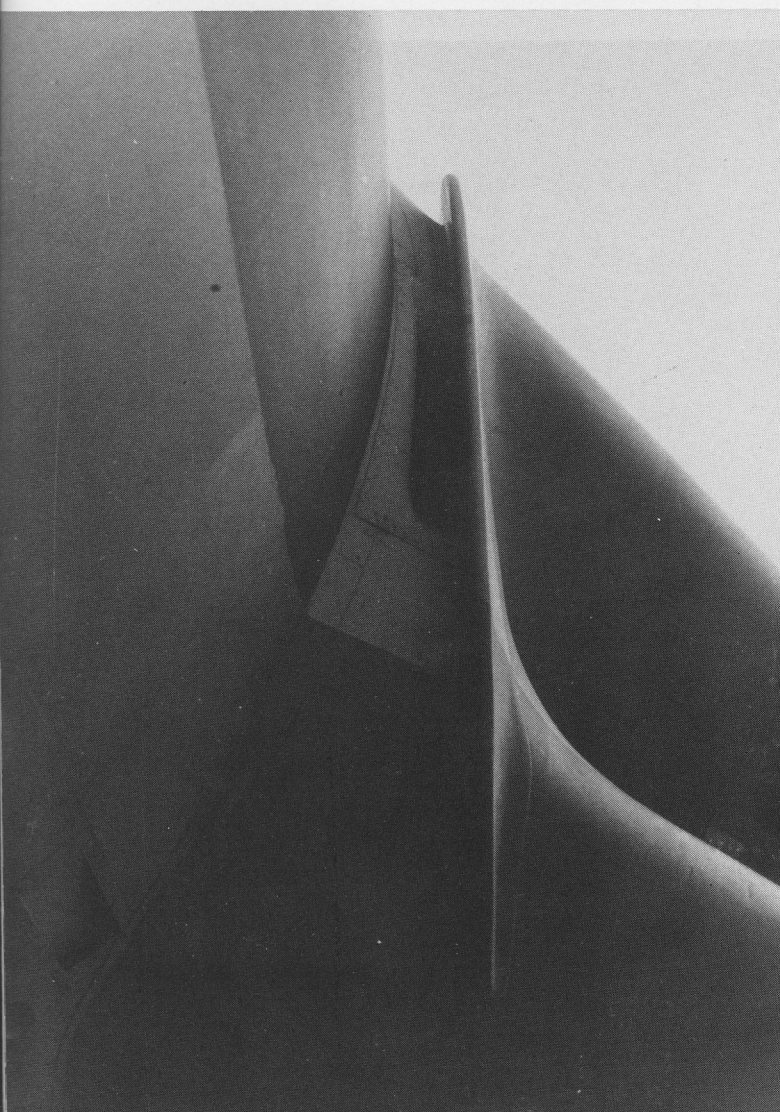
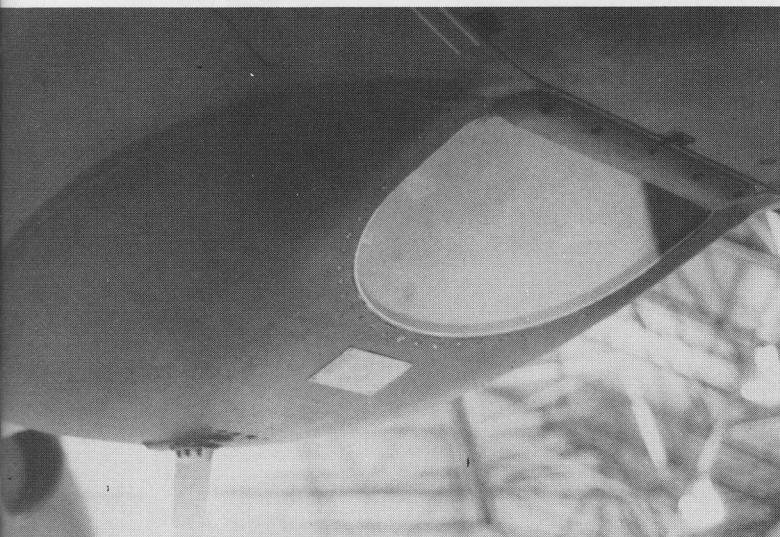
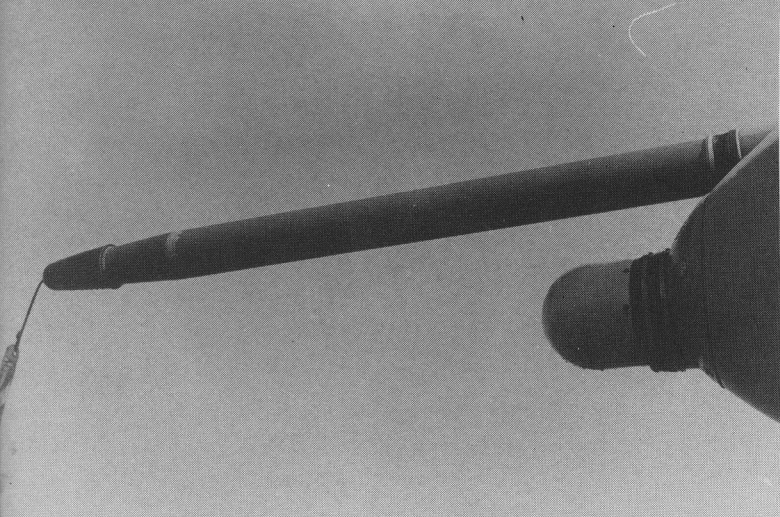
**Bottom:** Early morning frost recedes from the nose of Vulcan B Mk 2K XH561, February 1984. The fairing alongside the cockpit canopy houses a sextant mounting. Note observation port further aft.











**Opposite page top:** XM607 carried out three raids in all during the Falklands conflict, and appropriate symbols were later painted on the port side of the nose to commemorate these achievements. *Richard L Ward*

**Opposite page bottom:** The other Vulcan to conduct a strike against targets in the Falklands was the Shrike-carrying XM597, seen here in early 1984 with paintwork peeling but still bearing two mission symbols. The Brazilian flag marks the occasion of XM597's unscheduled landing at Rio de Janeiro on the way back from the second strike owing to a broken refuelling probe, 2 June 1982.

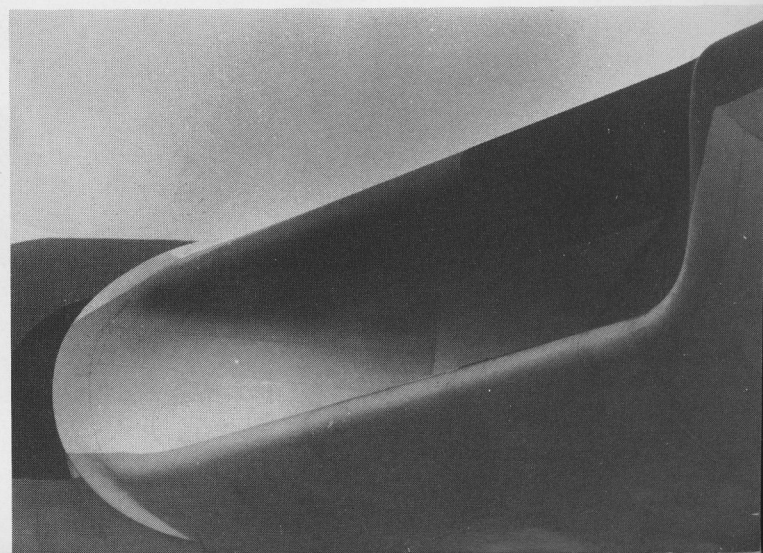
**Top left:** Close-up of Vulcan's probe and TF radome.

**Above left:** Bomb-aiming fairing, showing flat forward viewing panel and blade antenna.

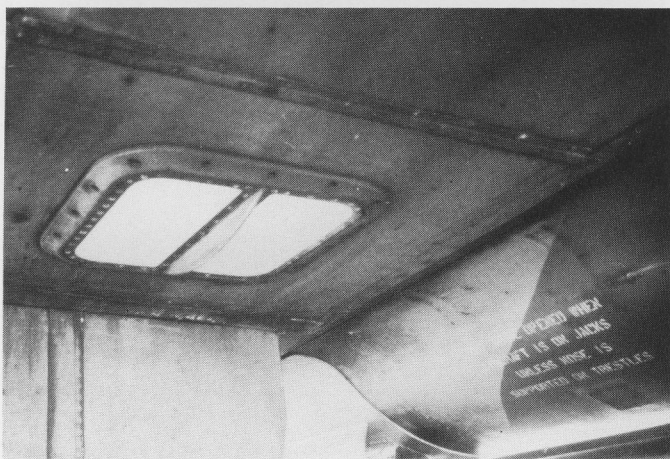
**Above:** Crew entry hatch (immediately forward of nosewheel), showing arrangement of access ladders.

**Left:** Port wing splitter plate, showing auxiliary intake in 'hidden' area between plate and fuselage.

**Below:** Port main intake, showing smooth, rounded contours. Intake blank resides deep within, and is just visible.







**Above:** Doppler radar panel, situated on port wing immediately behind main gear bay, rear door of which is clearly in evidence.

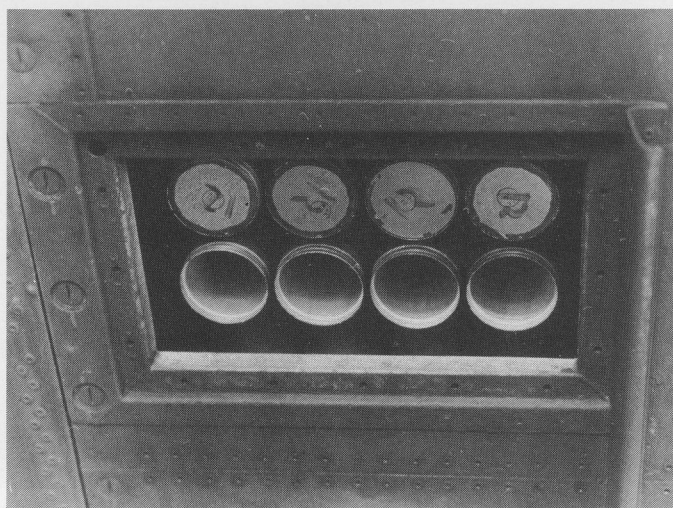
**Above right:** Pitot head and other detail on starboard fuselage side above nosewheel bay.

**Right:** Close-in view of flare chutes carried by B Mk 2 XL426 in early 1984; chaff (port) and flare (starboard) dispensers are fitted aft of main gear bays, and are the standard decoy measures to counter, respectively, radar-homing and heat-seeking missiles.

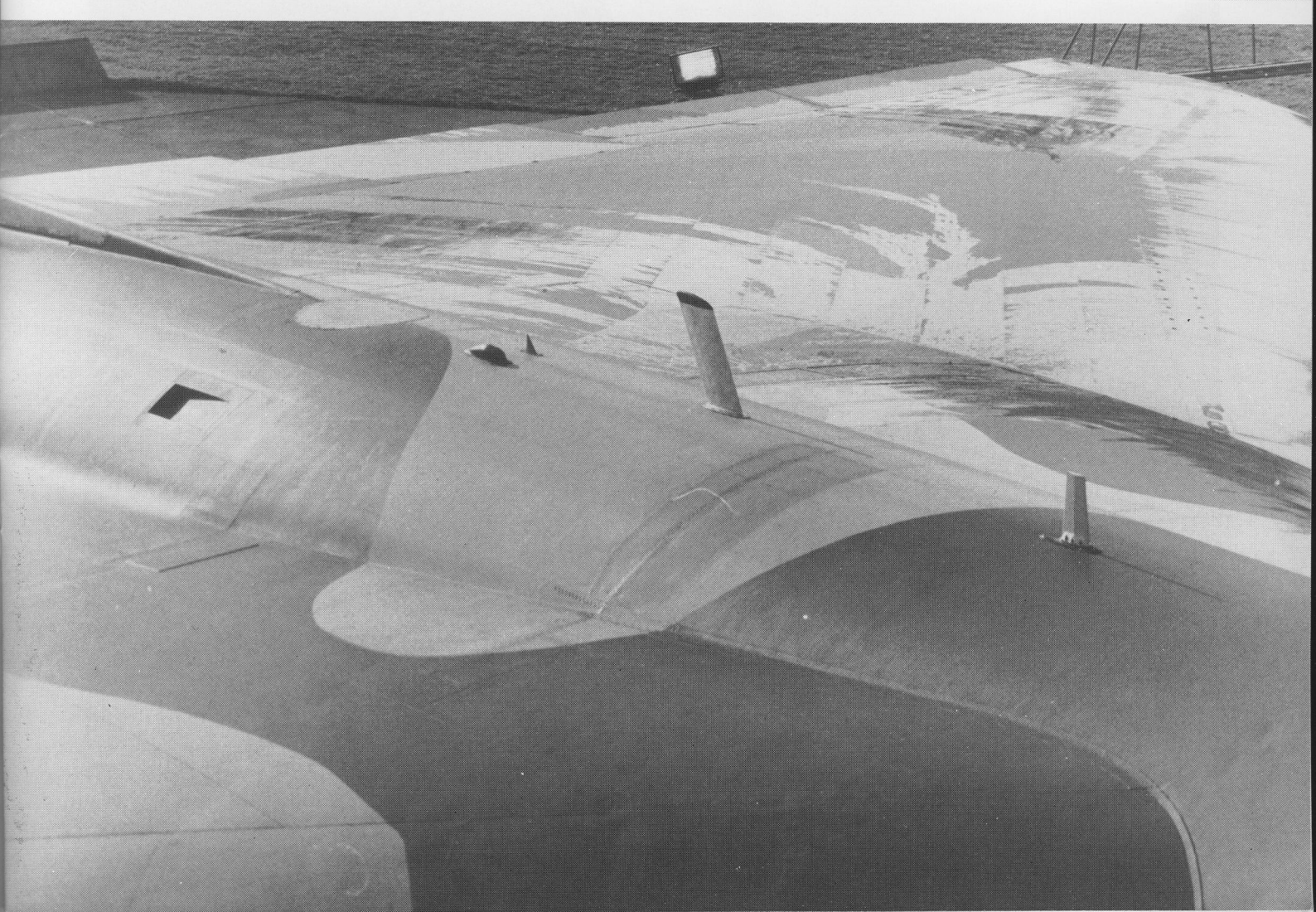
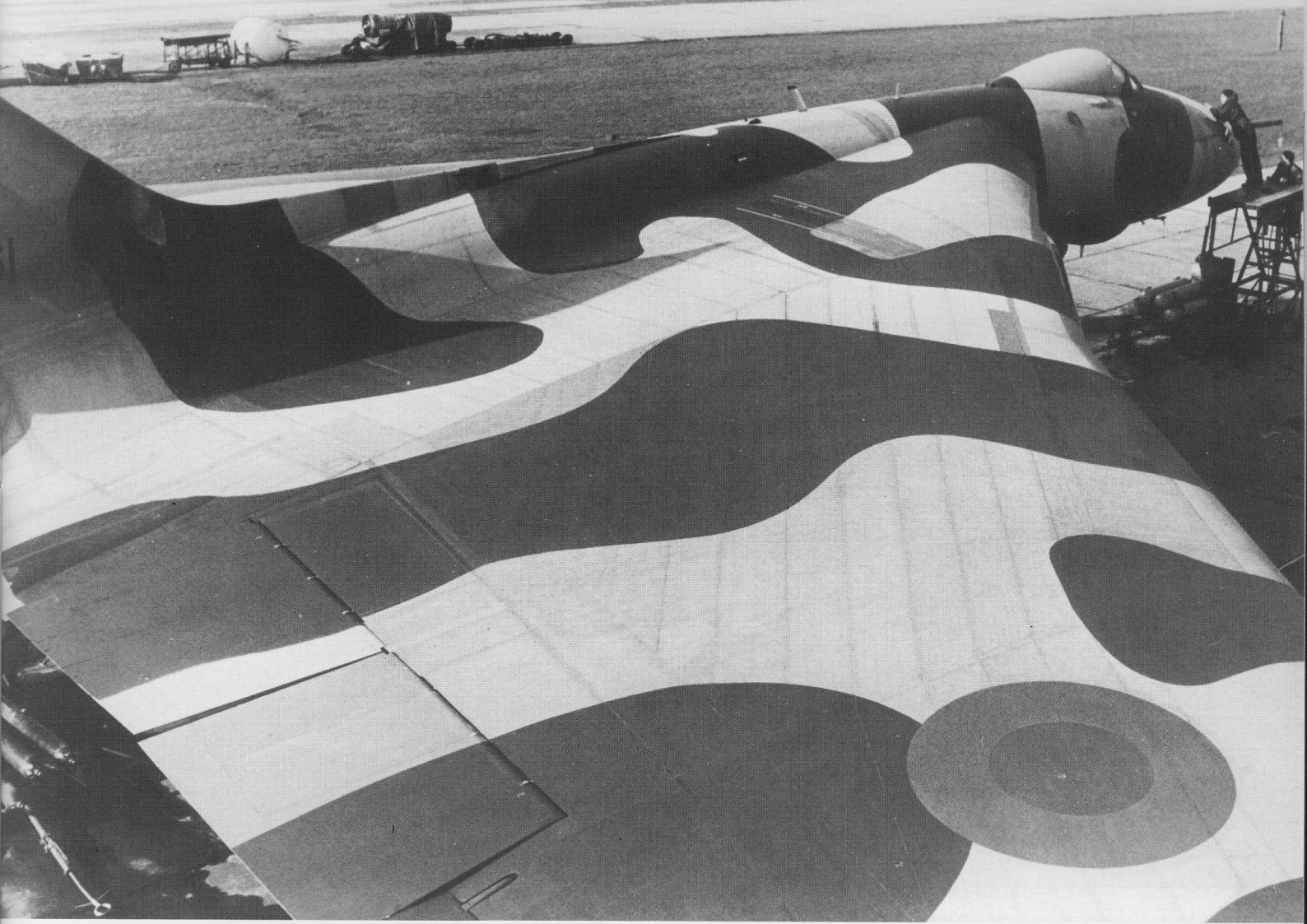
**Below:** Undersides of B Mk 2K XH561. The aircraft is being readied for a flight.

**Opposite page top:** The vast expanse of the Vulcan wing is well shown in this photograph. Note the prominent panel lines and the 'hard' edges to the camouflage pattern.

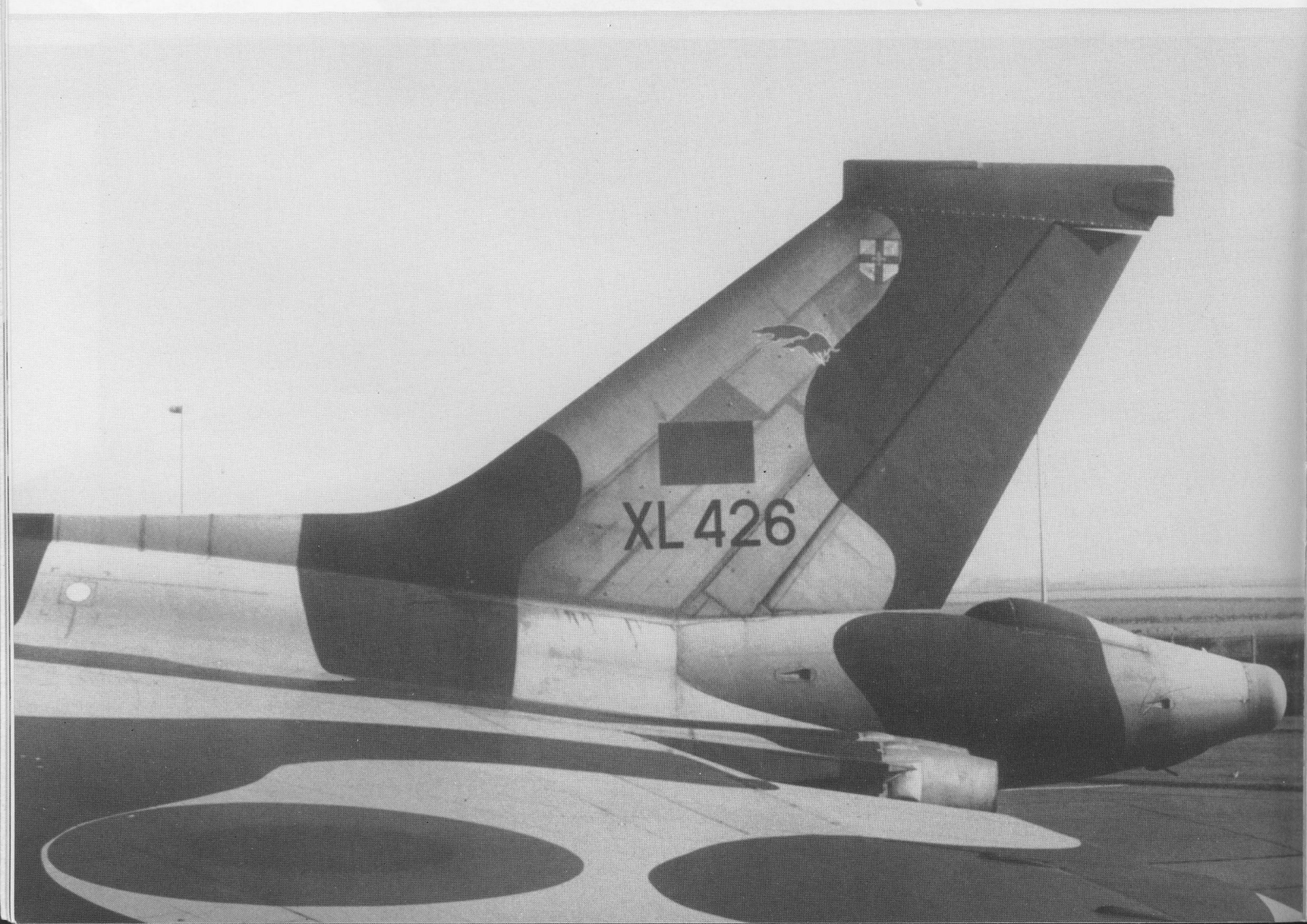
**Opposite page bottom:** Upper fuselage details, including communications antennas (the larger offset to port), anti-collision light, dielectric panel and bomb bay air conditioning inlet.



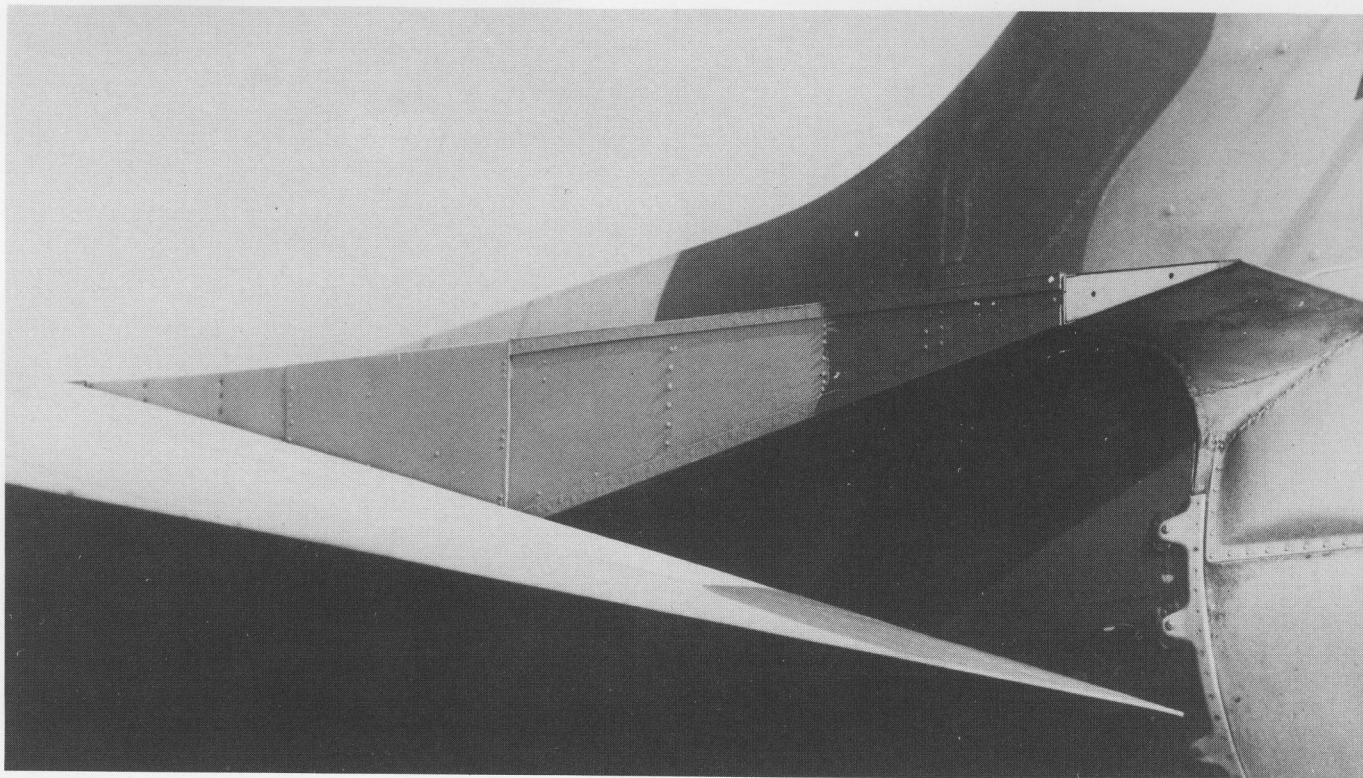












**Opposite page top:** Vulcan uppersurfaces, port side. The parallel markings behind the main intake indicate the position of the upper air brakes.

**Opposite page bottom:** Another view

from the port side. Note how the wing roundel 'misses' the Dark Green camouflage.

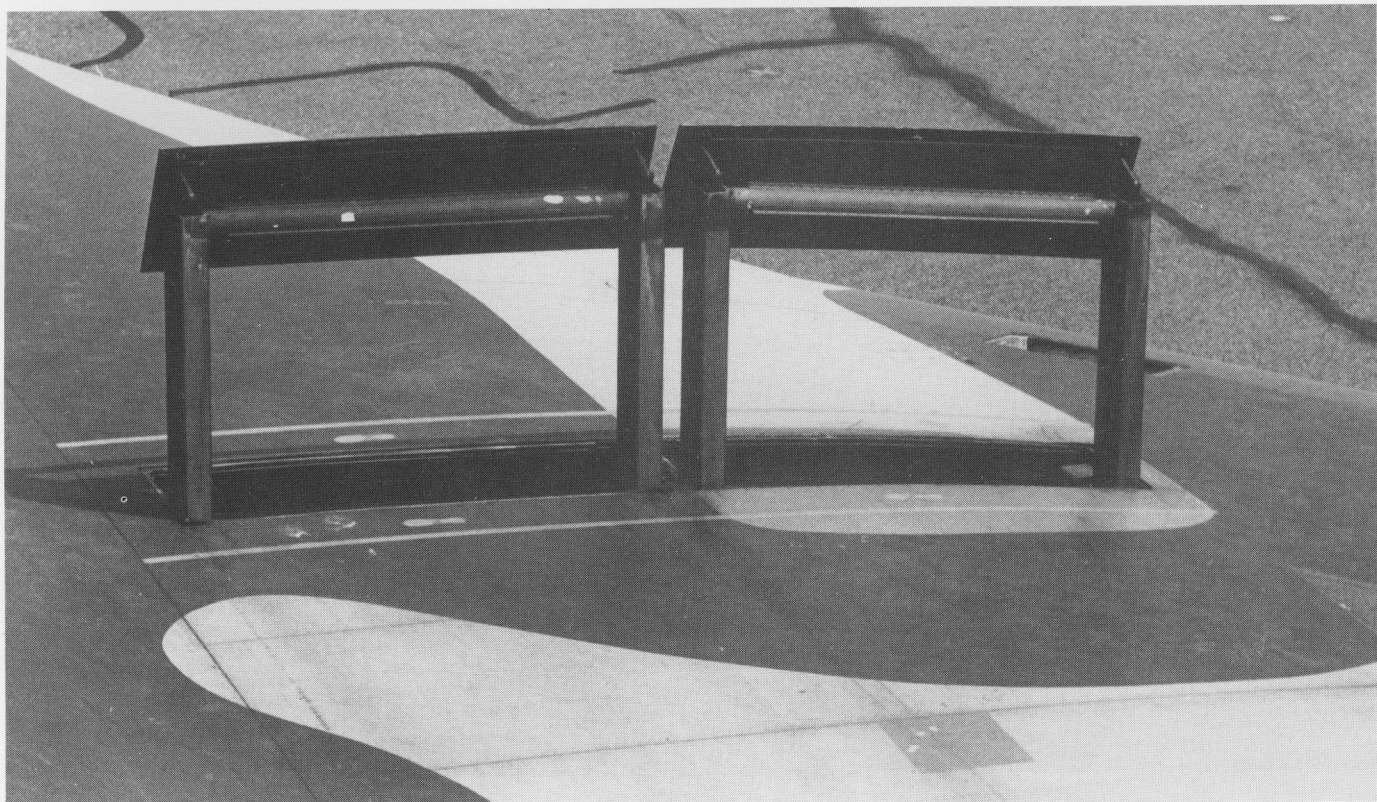
**Above:** Horizontal movable surfaces on the Vulcan comprise ailerons outboard and elevators inboard. This photo

shows the inboard section of the port inner elevator; note sharpness of trailing edge.

**Below:** Detail of wing trailing edge inboard of jet pipes, starboard side. Again, note smoothness of contours.







**Above:** Starboard upper wing air brakes in extended position. *Bob Downey*

**Below:** Trailing edges of ailerons contrast with those of elevators.

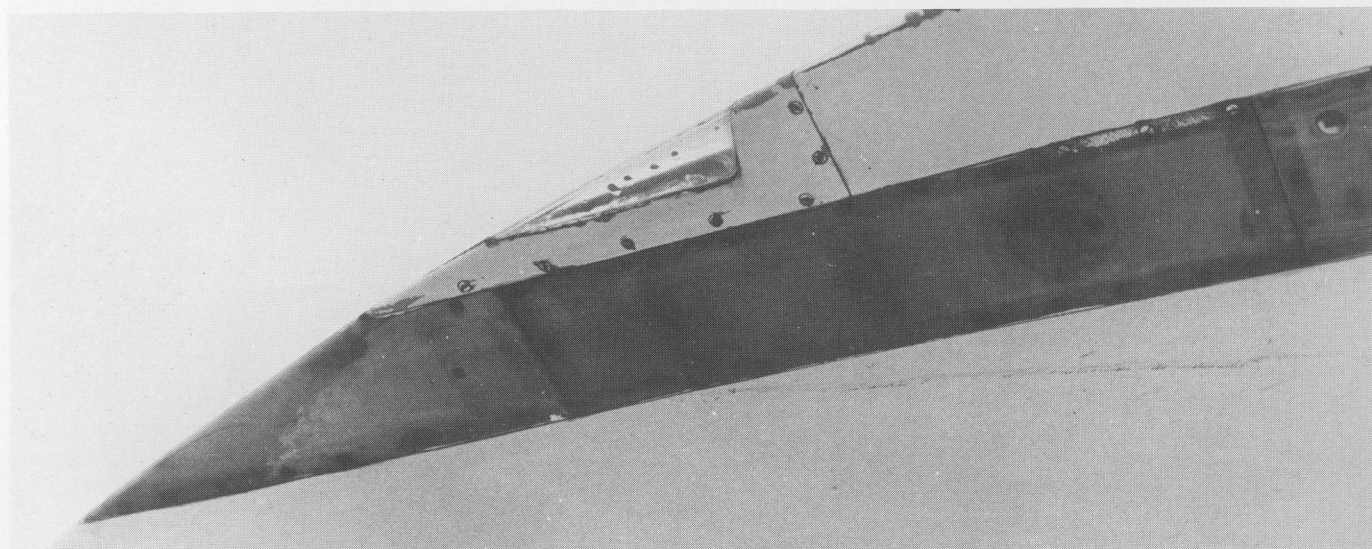
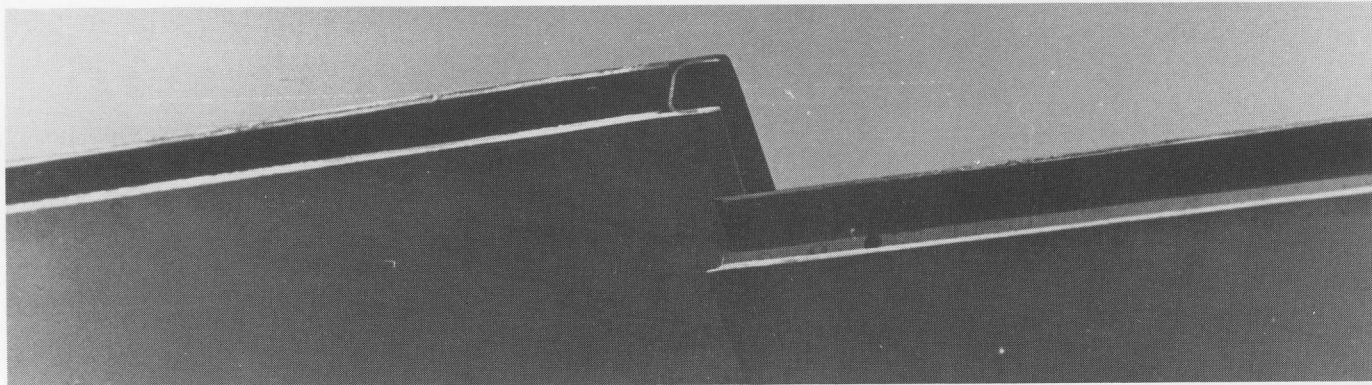
**Bottom:** Port wing tip of B Mk 2K

XH561, showing navigation light.

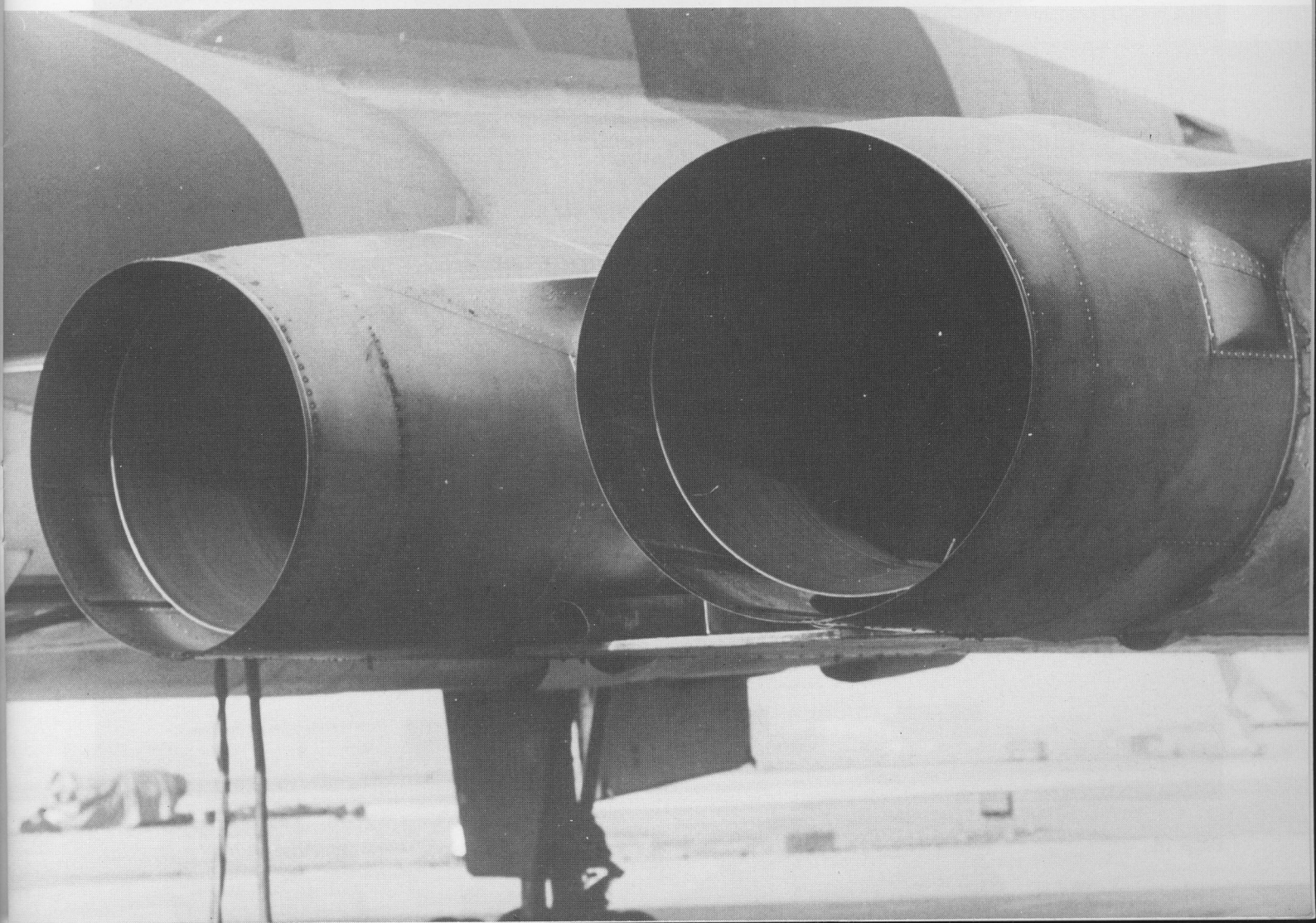
**Opposite page top:** Early B Mk 2s were fitted with 17,000lb thrust Olympus 201 engines, but later aircraft had 20,000lb thrust 301s installed in

order to cope with the demands of Skybolt; 300-series tailpipes are shown.

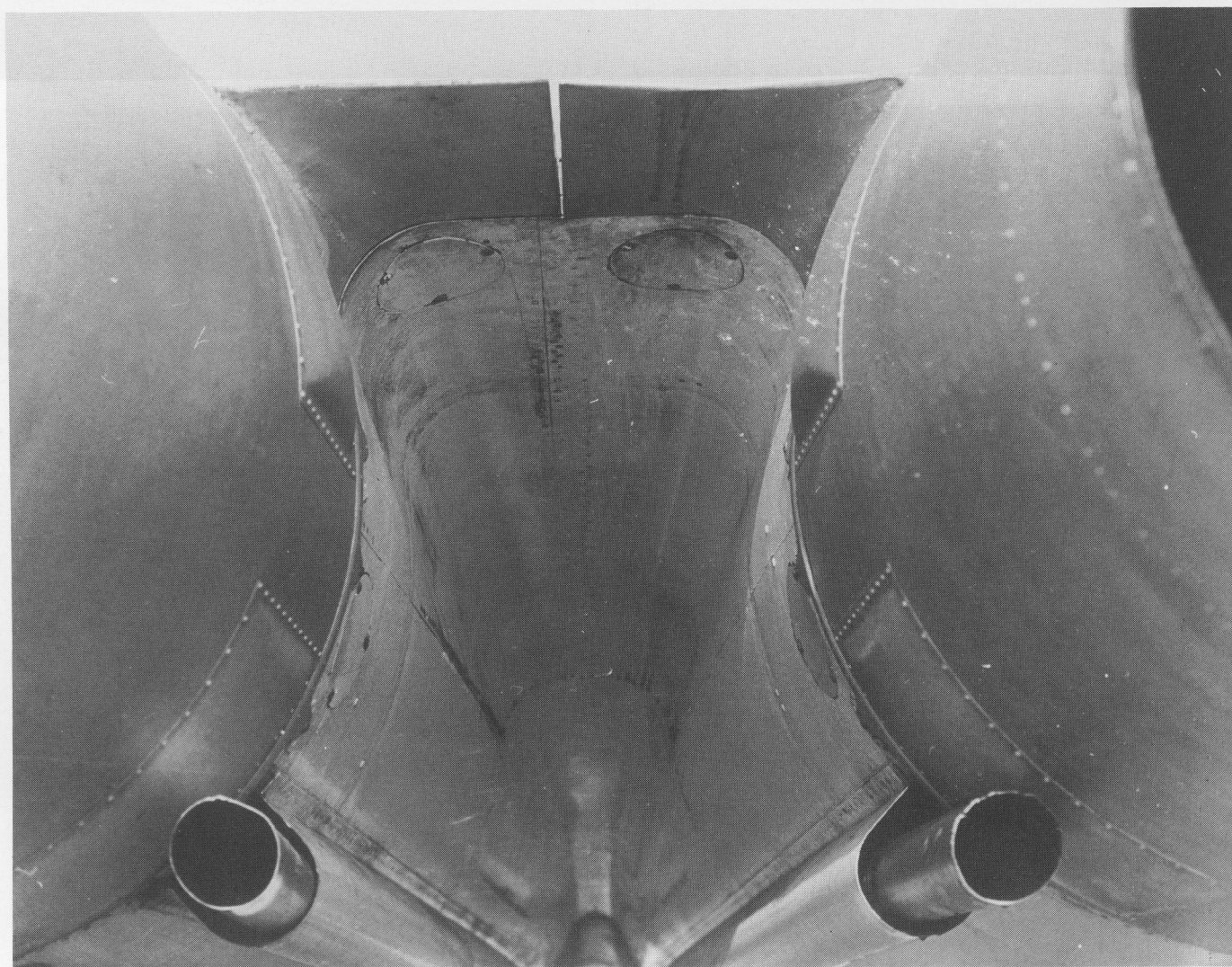
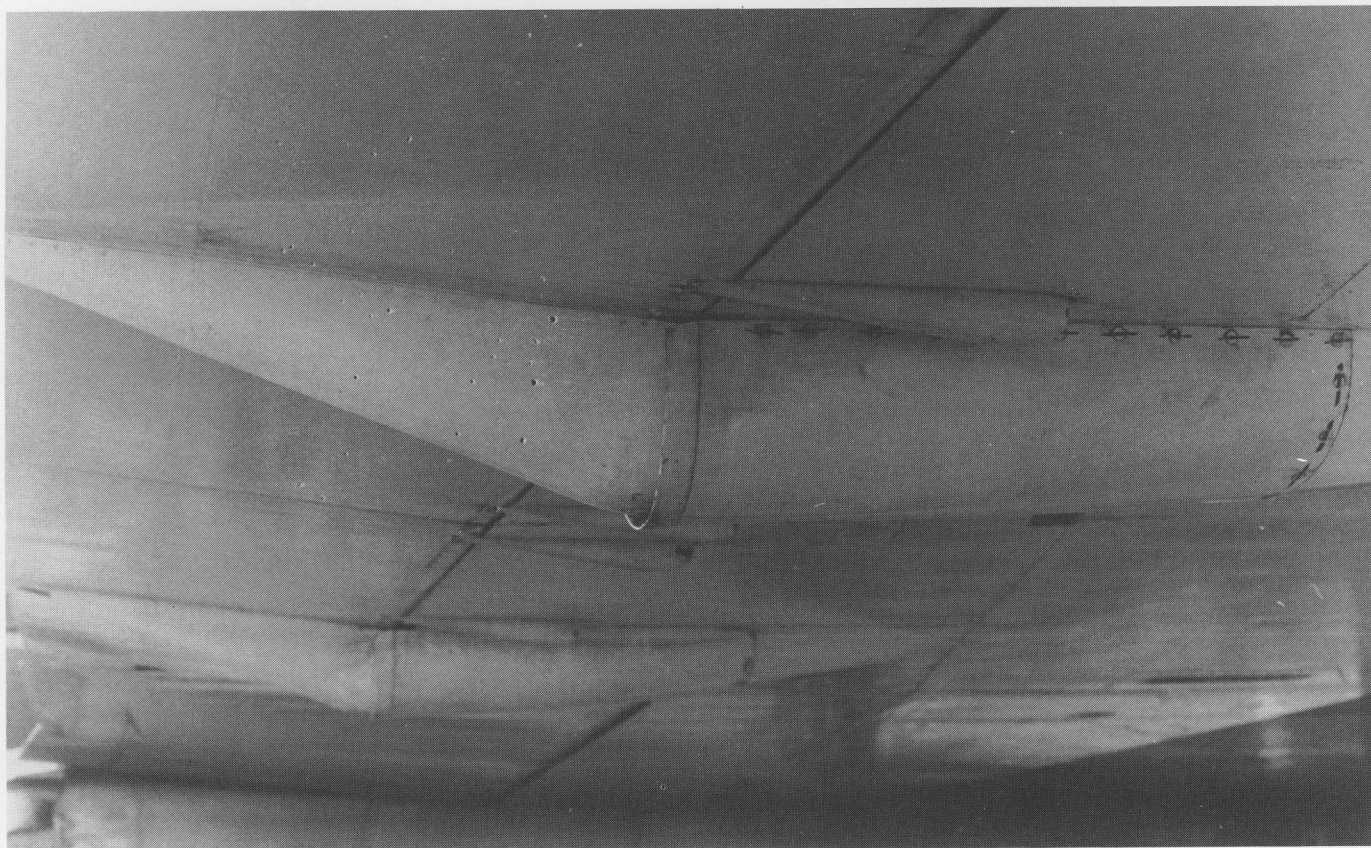
**Opposite page bottom:** The longer Olympus 201 tailpipes, as fitted to XH561 (and, indeed, all Vulcan tankers).















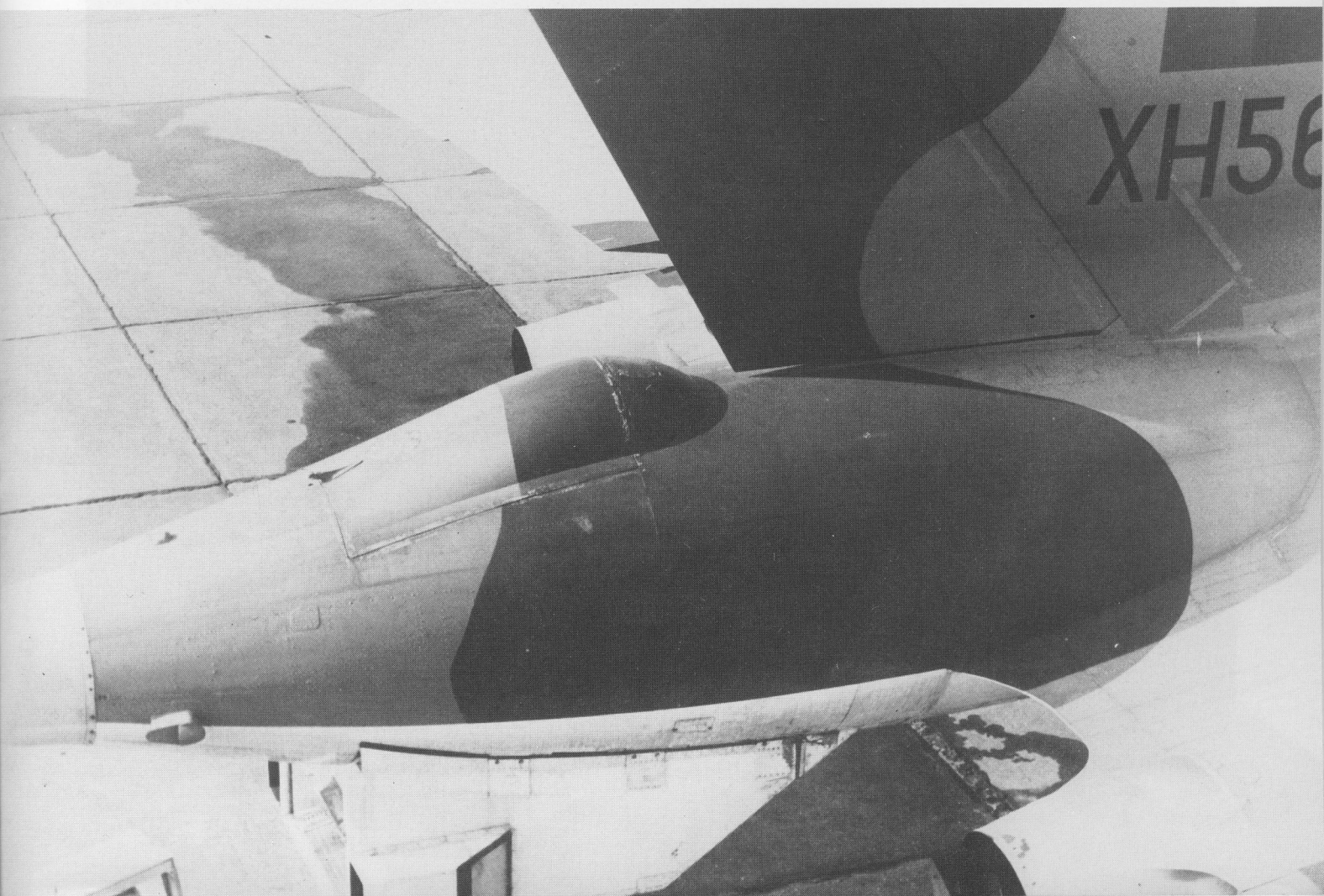
**Opposite page top:** Aileron actuator fairings, starboard wing.

**Opposite page bottom:** 'Channel' between 200-series tailpipes, showing prominent oil breathers. Starboard wing

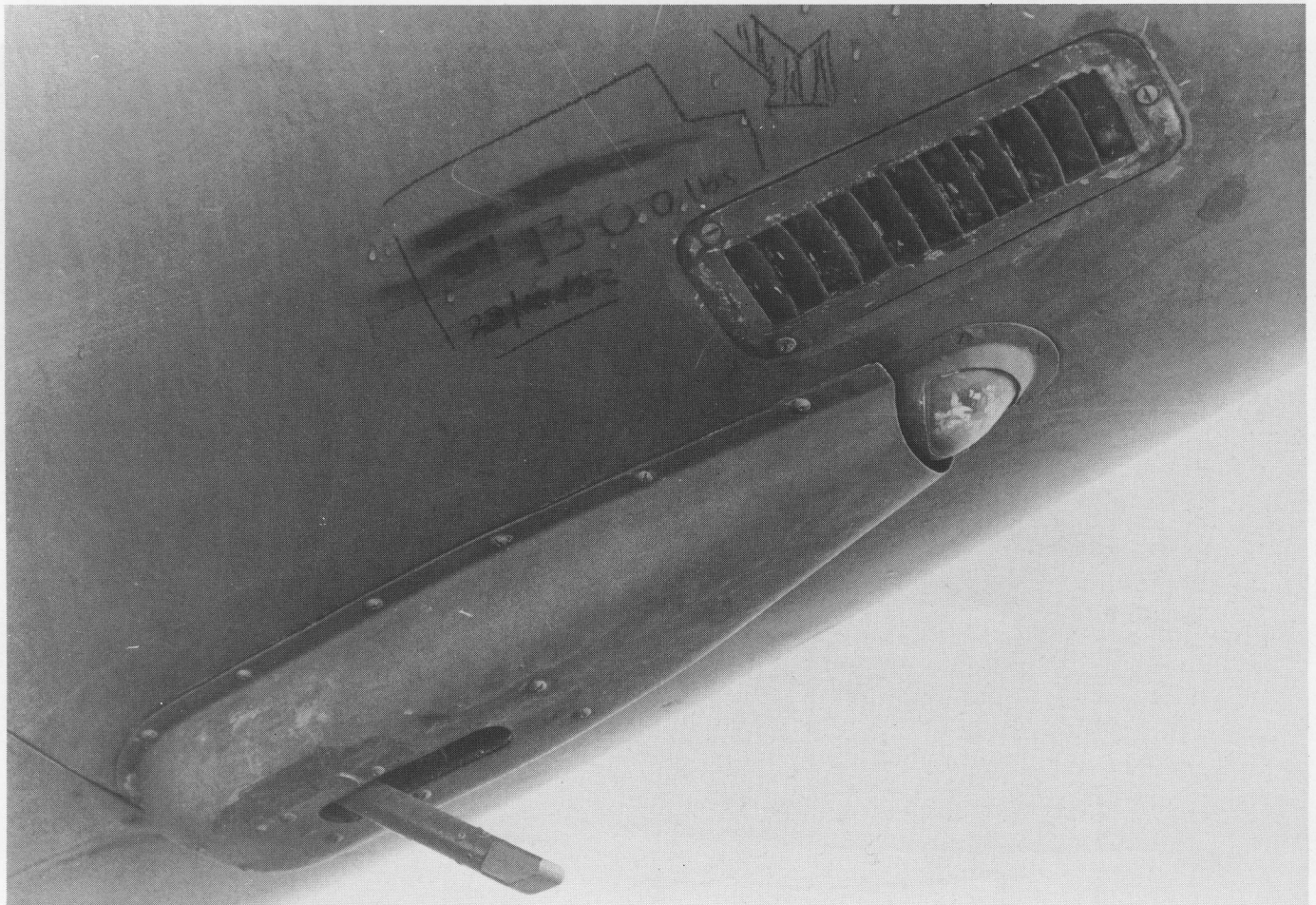
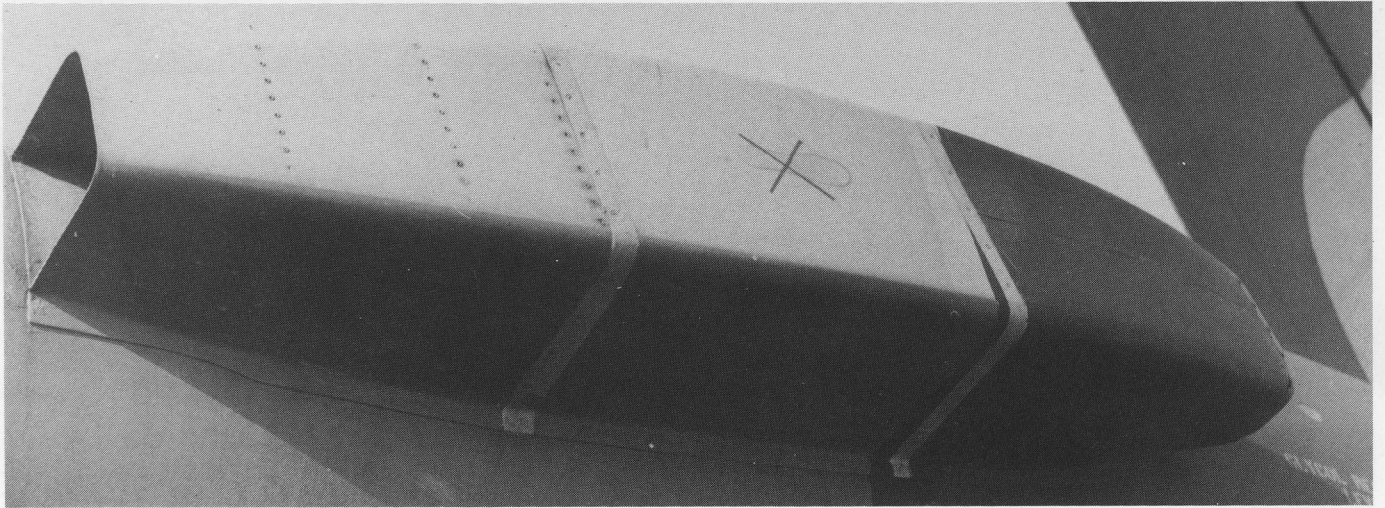
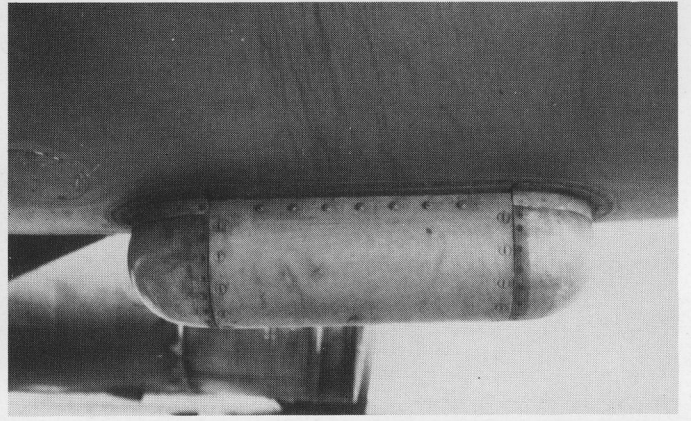
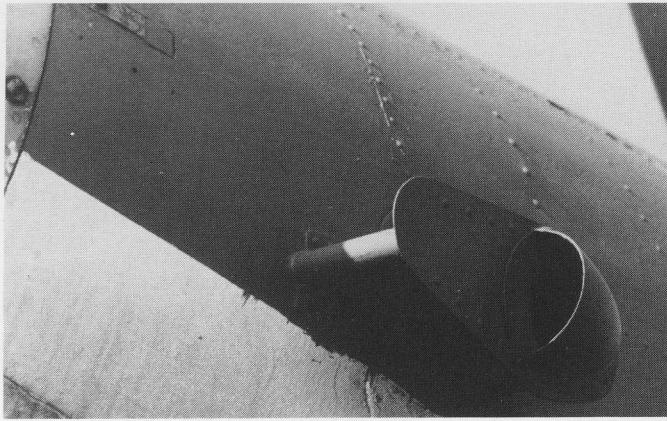
has ECM plate fitted below pipes.

**Above:** Rear fuselage and tailfin, B Mk 2K. Overpainted fin insignia reveals that this particular Vulcan was formerly assigned to No 35 Sqn.

**Below:** Uppersurfaces of tail fairing of the same aircraft, showing brake parachute housing; the ECM cooling intake (see photo on page 16) has been removed. Note winching point at back.











**Opposite page top left:** Fuel dump on tail fairing, starboard side only.

**Opposite page top right:** Radar warning receiver (RWR) 'tub' beneath tail of B Mk 2 XM597.

**Opposite page middle:** ECM equipment bay cooling intake, B Mk 2.

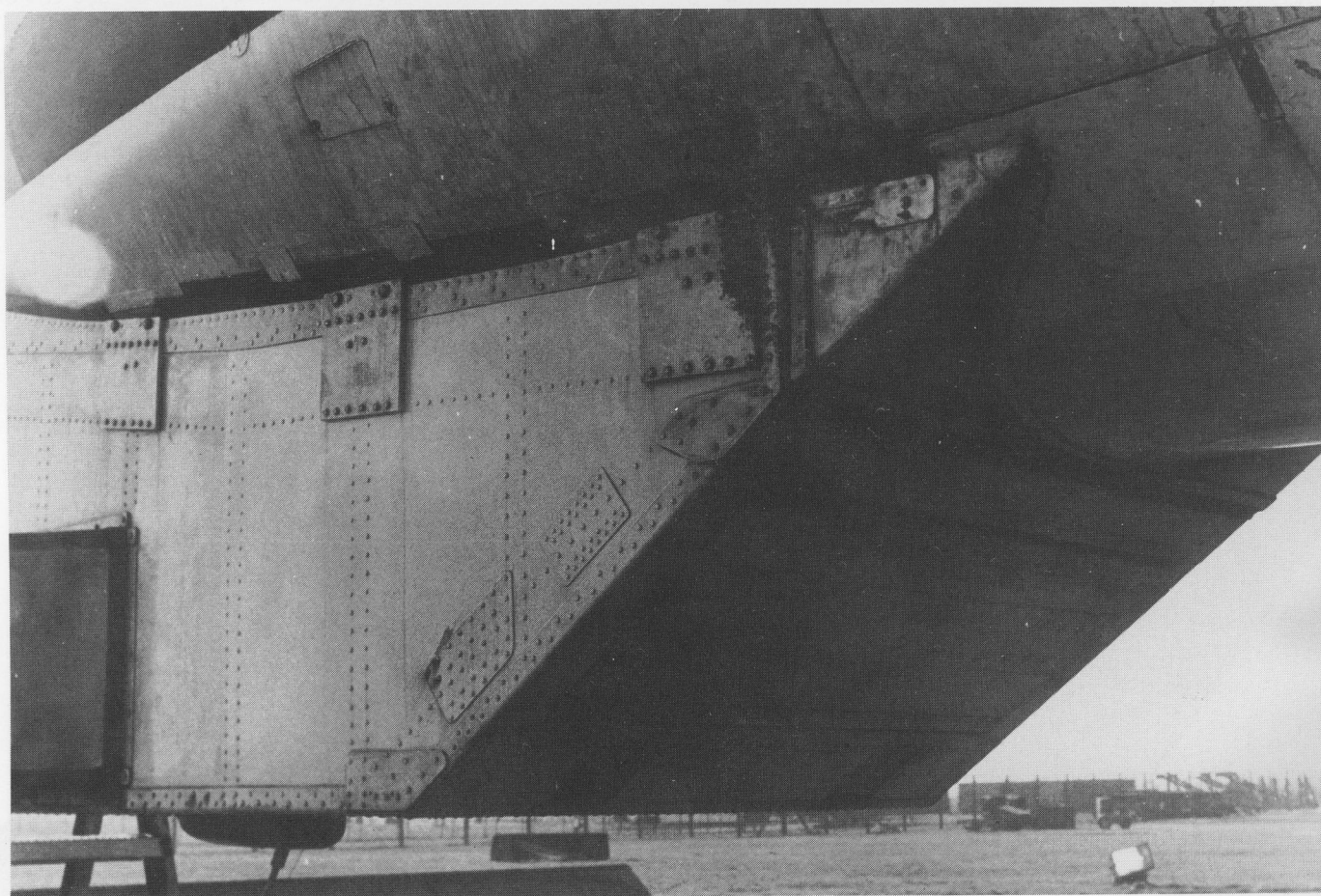
**Opposite page bottom:** Tailskid sensor, navigation lamp and outlet grille below B Mk 2 tail fairing.

**Above:** No 50 Sqn 'dingoes' and City of Lincoln insignia adorn fin of XH561.

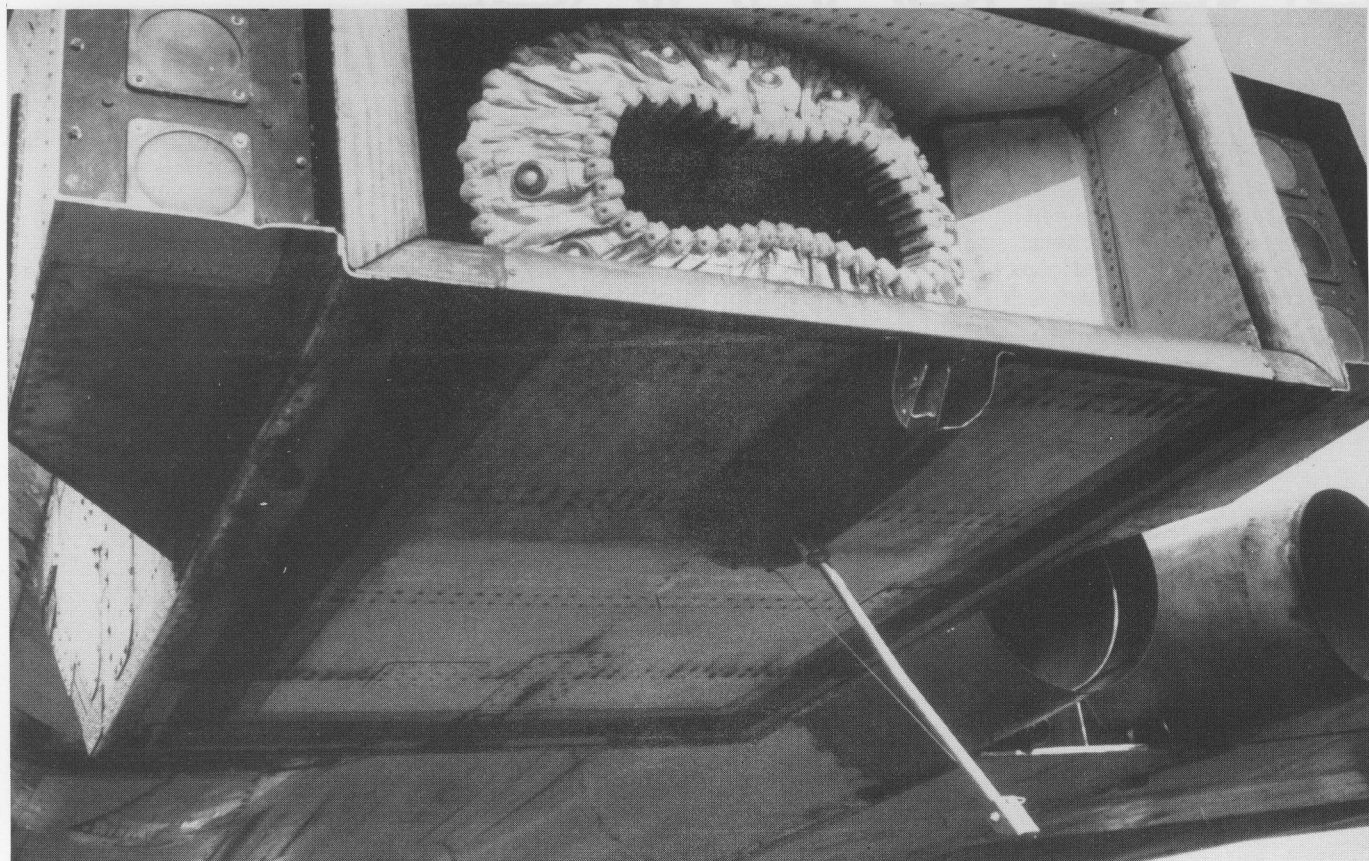
**Below:** B Mk 2 XM597's fin, bereft of insignia of No 101 and No 44 Sqns, with which units the aircraft once served.







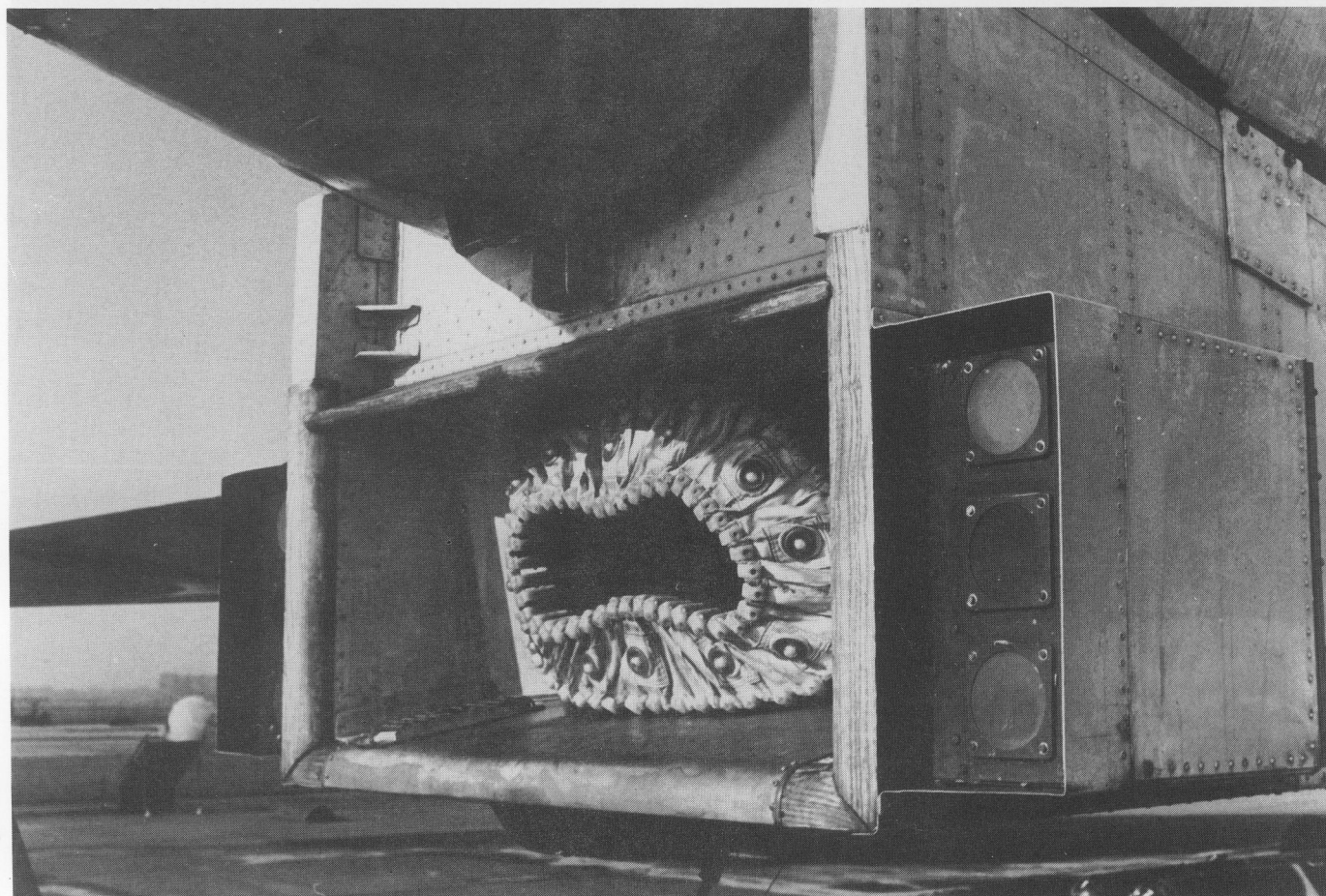




**Opposite page top:** Mk 17 Hose Drogue Unit (HDU, known as a 'hoodoo' or 'skip'), distinguishes B Mk 2K tankers.

**Opposite page bottom:** Front of HDU.  
**Above:** Undersurfaces of HDU, showing tailskid sensor.  
**Below:** Close-up of drogue 'basket';

this deploys aerodynamically but is reeled in by an electro-hydraulic motor. 'Ready' lights each side of HDU are amber (top), green and red.





# UNDERCARRIAGE

**Below:** Port nosewheel door of B Mk 2, showing LORAN antenna, natural metal finish with red tips. *Richard L Ward*

**Bottom left:** Nosegear leg and twin nosewheels. Leg is semi-gloss black and wheel hubs are silver; sheen on tyres is noteworthy. Aircraft serial appears in yellow on forward lower edge of both nosewheel doors.

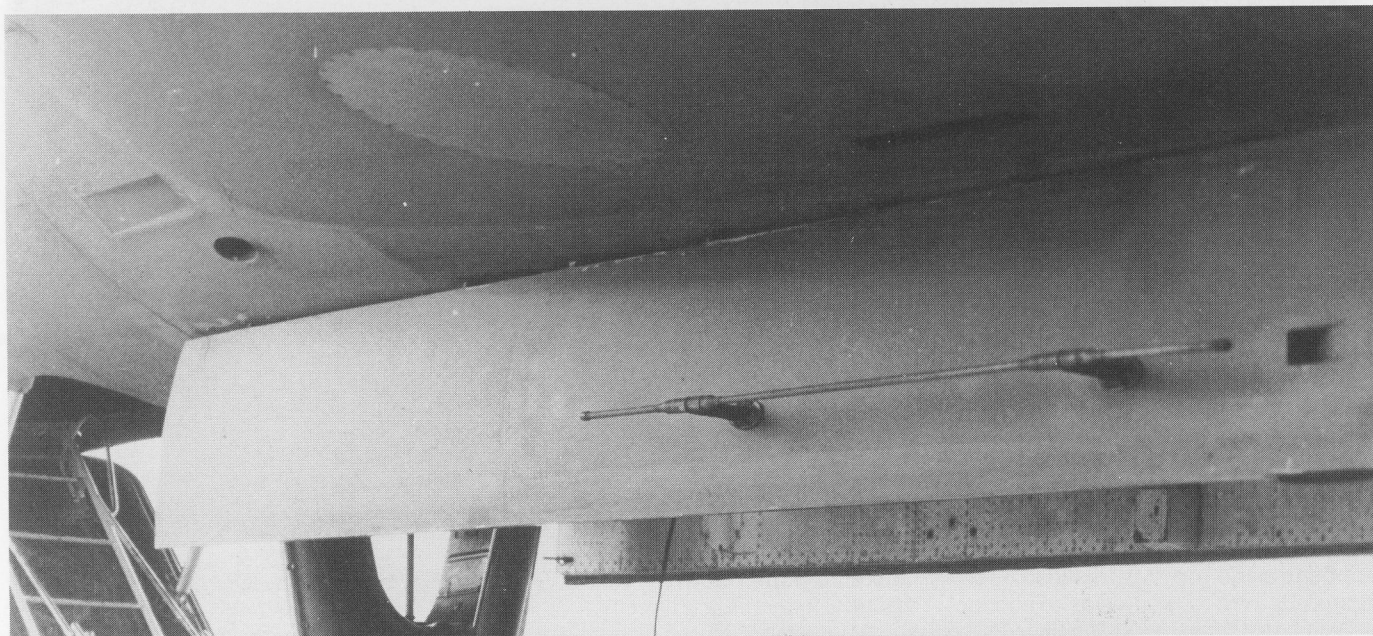
**Bottom right:** Starboard mainwheel unit; finish is similar to that of nosegear.

**Opposite page top left:** Detail of starboard main gear, showing eight-wheel bogie configuration, oleo calipers, hydraulic lines etc. Note stay at top left of photo.

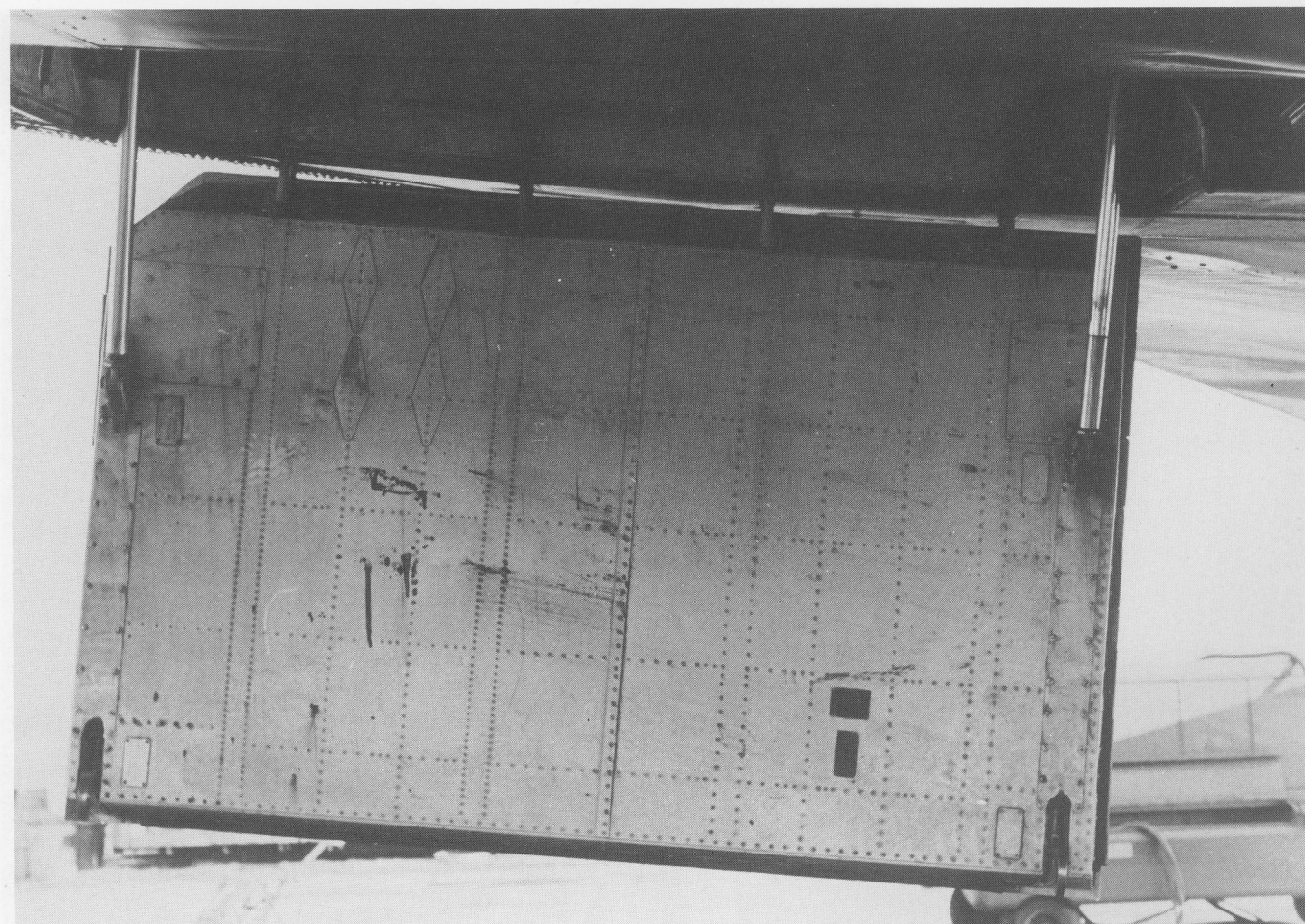
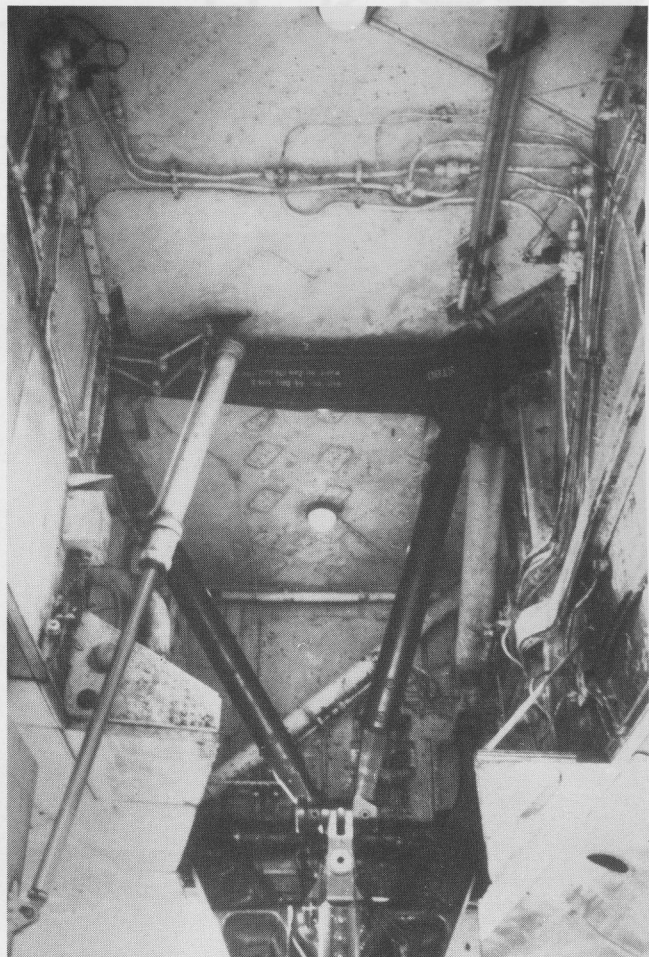
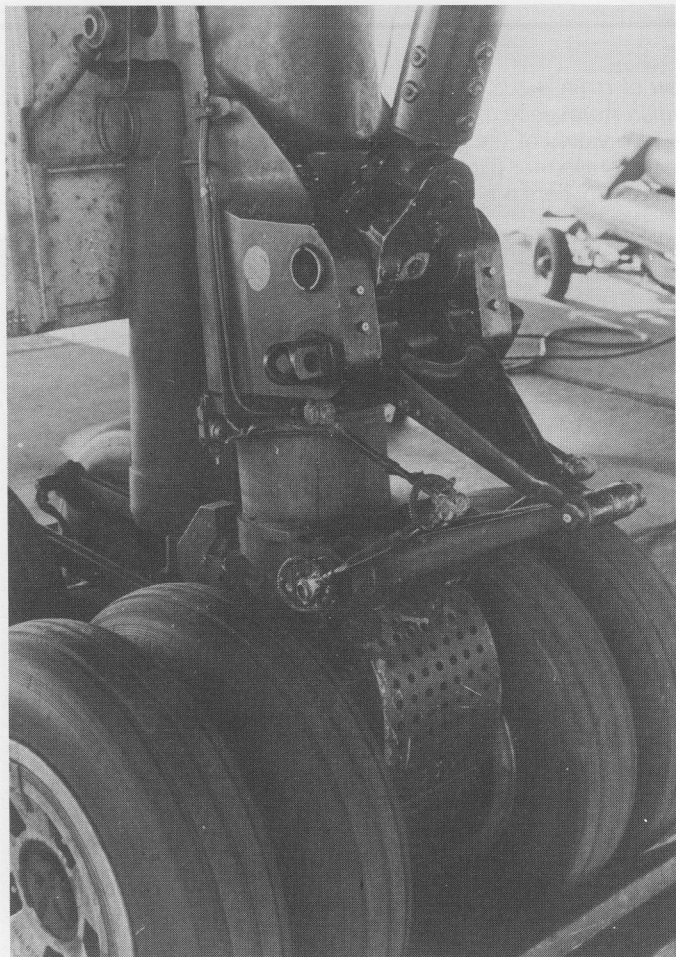
**Opposite page top right:** The

cavernous interior of the Vulcan's main gear bay; this is the starboard unit. Interior finish is semi-gloss white. Note servicing lights on roof of bay.

**Opposite page bottom:** Inside surfaces of forward main gear door, starboard side, showing bright metal retraction jacks and, along bottom edge of door, locking clips.









# COCKPIT

**Below left:** Pilot's flying instruments and console, B Mk 2. Note 'fighter'-type control stick. *British Aerospace*

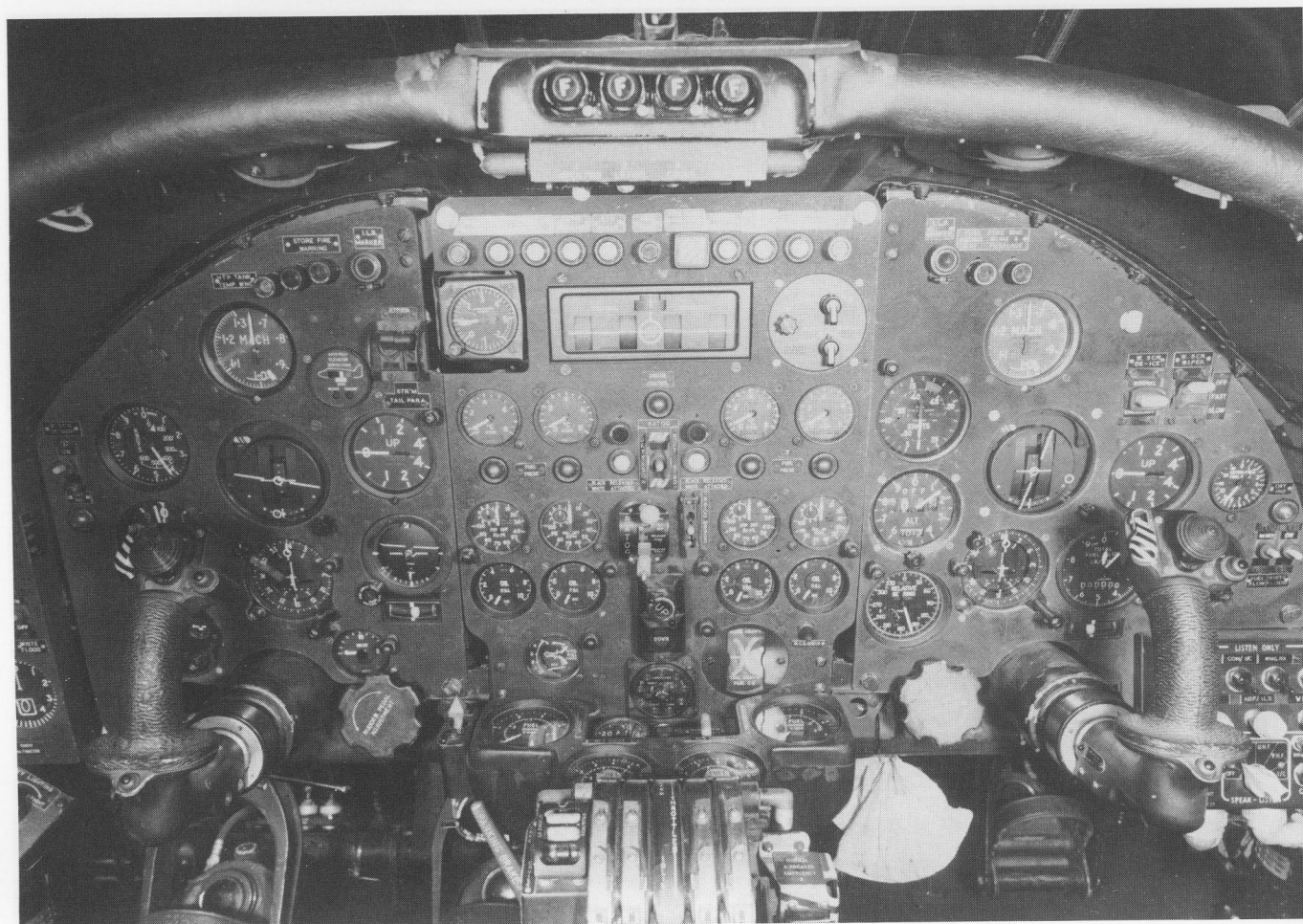
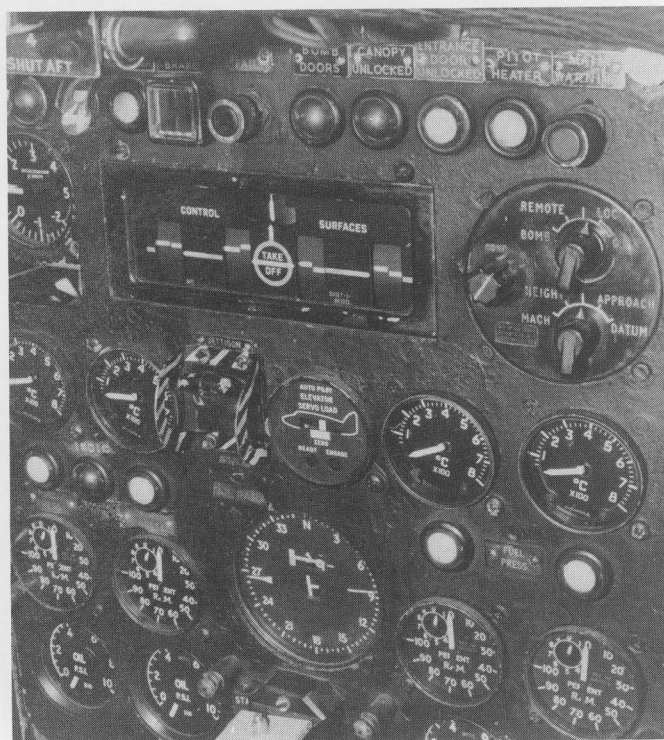
**Below right:** Detail of main instrument panel from co-pilot's position, B Mk 2K.

**Bottom:** General view of main instrument panel. *British Aerospace*

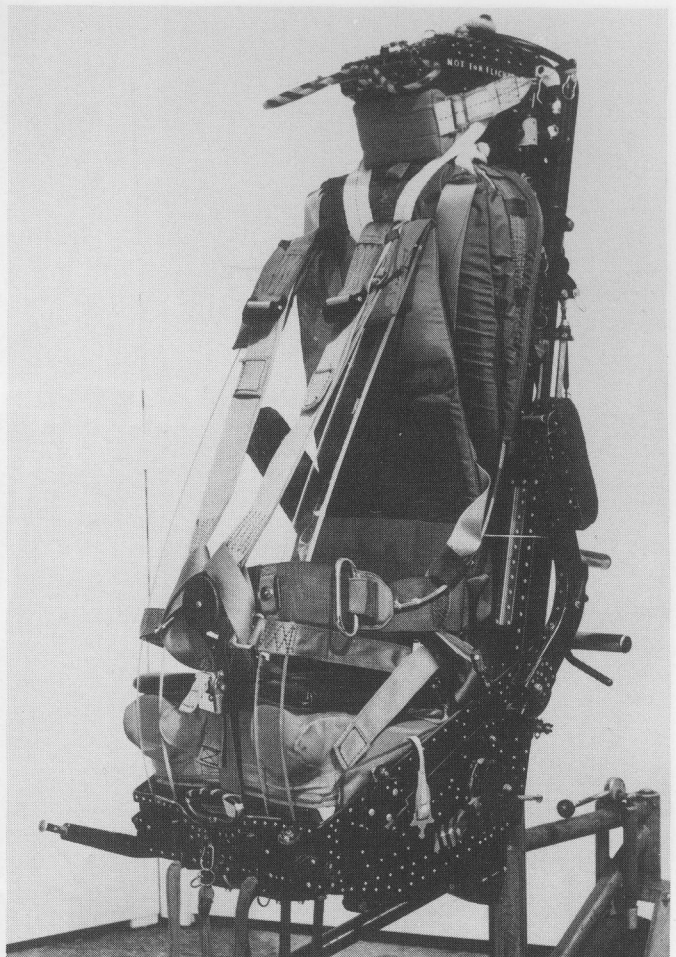
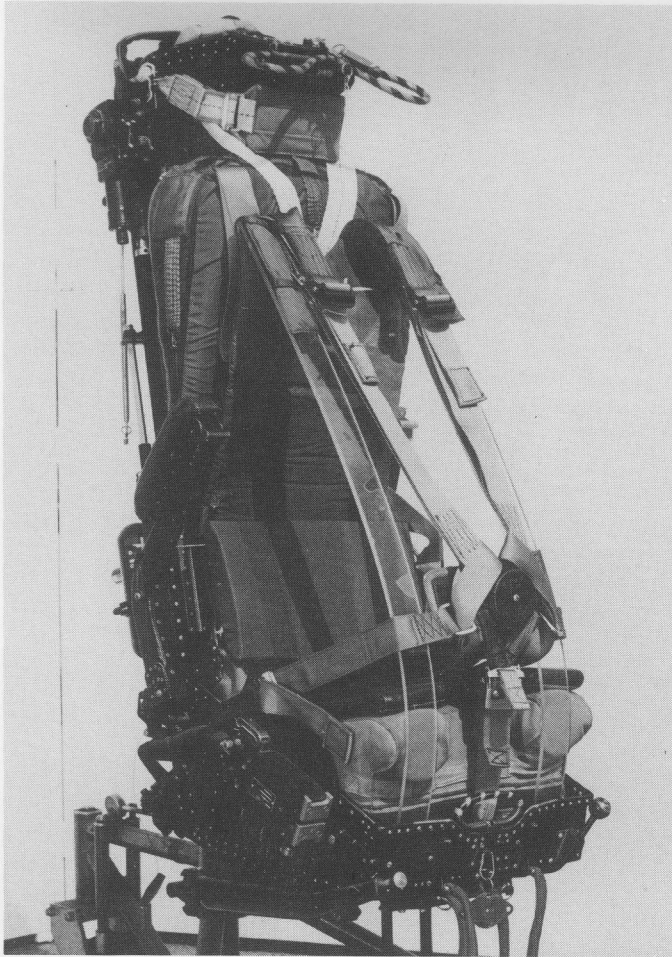
**Opposite page top:** Two views of the Type 3KS ejection seat installed for pilot and co-pilot only. Perspex spacers are

for manufacturer's display purposes. *Martin-Baker Aircraft Co Ltd*

**Opposite page bottom:** Detail of harness fitted to one of the rear-facing crew seats.



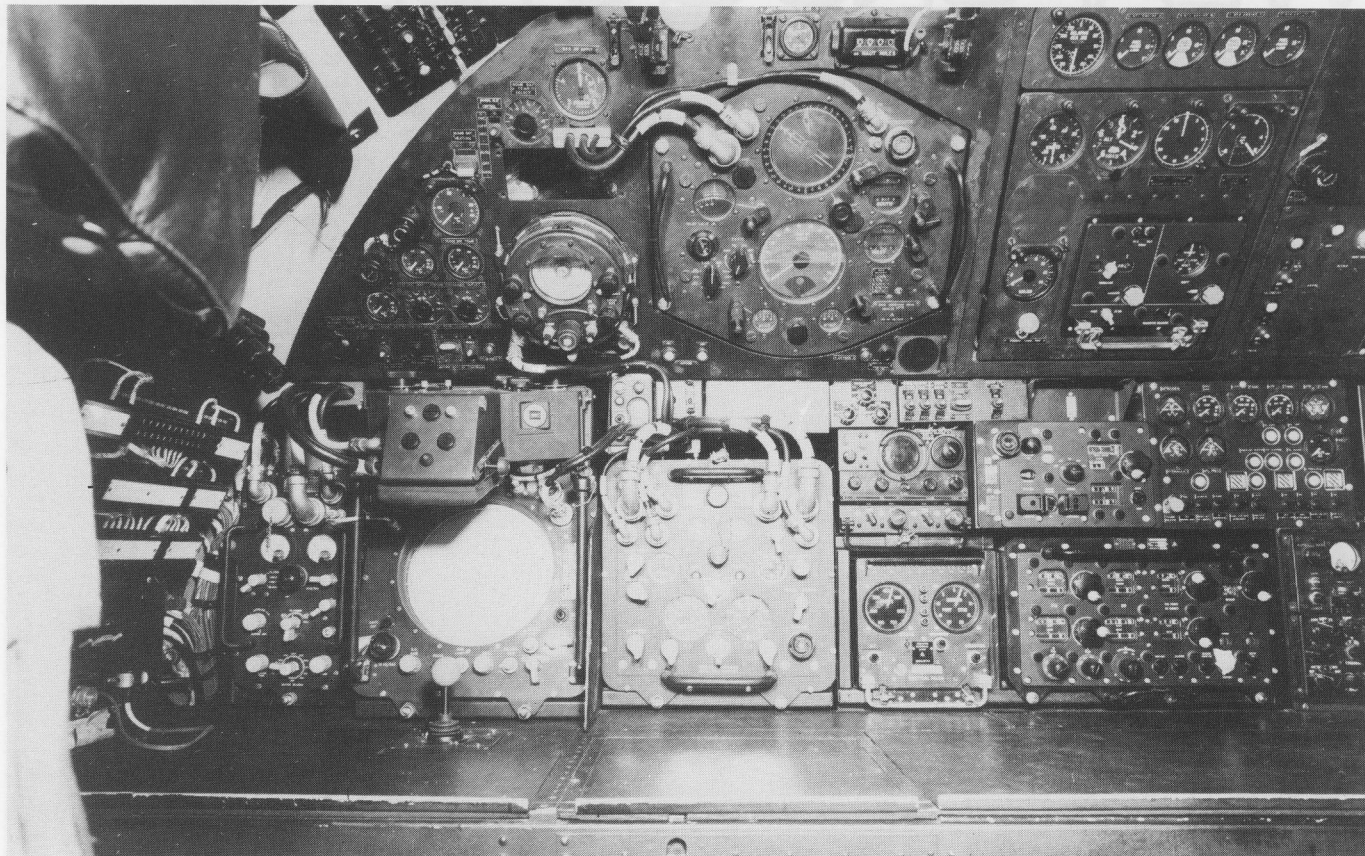








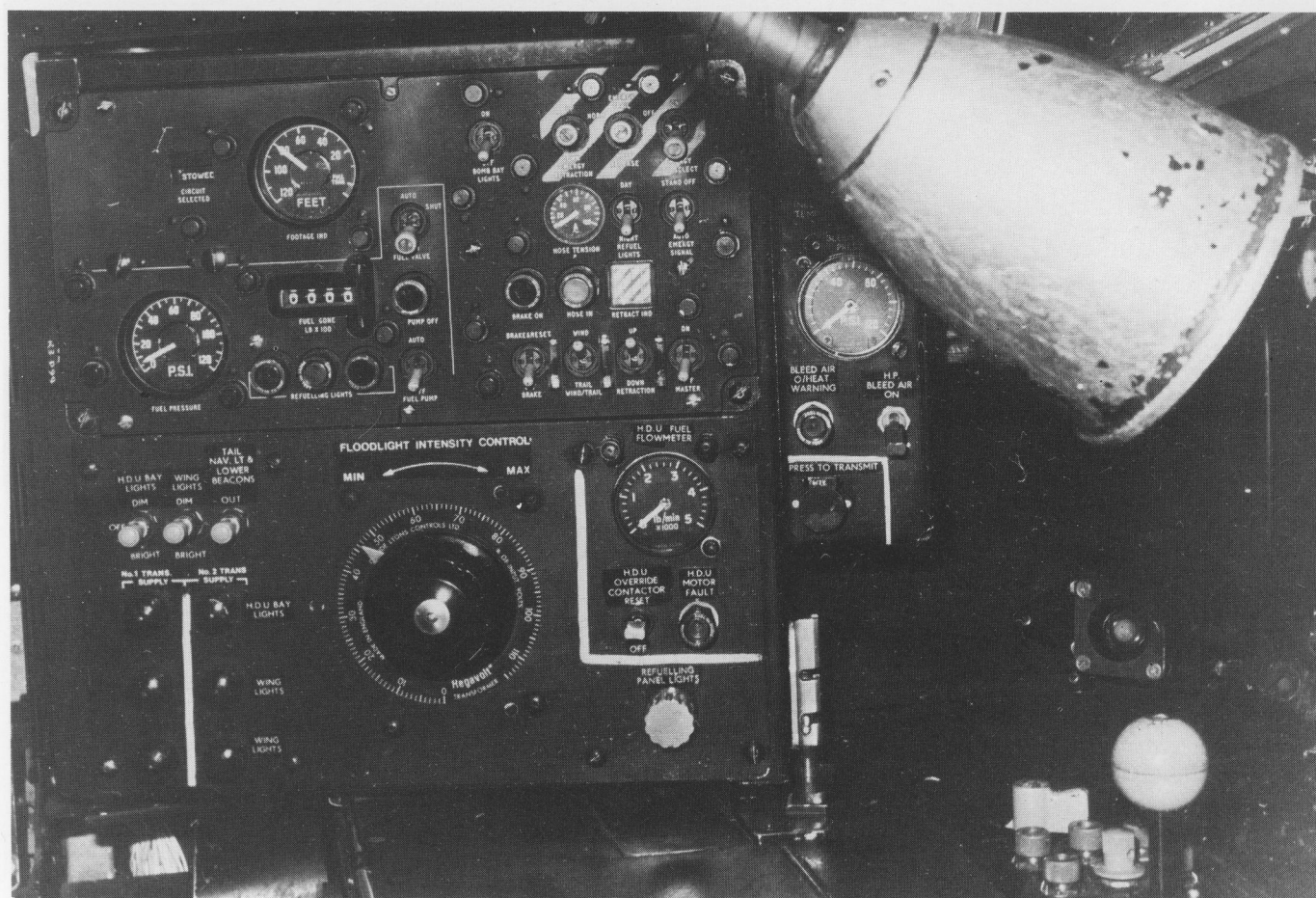




Opposite page top: Air Electronics Officer (AEO) position (to port), early B Mk 2. *British Aerospace*  
Opposite page bottom: Upper

instrument panels, AEO and (left) Nav Plotter's position. *British Aerospace*  
Above: Third rear-facing crew position is that of Nav Radar. *British Aerospace*

Below: In Vulcan tankers, Nav Radar had responsibility for refuelling operations, conducted via this specially fitted instrument panel to his left.



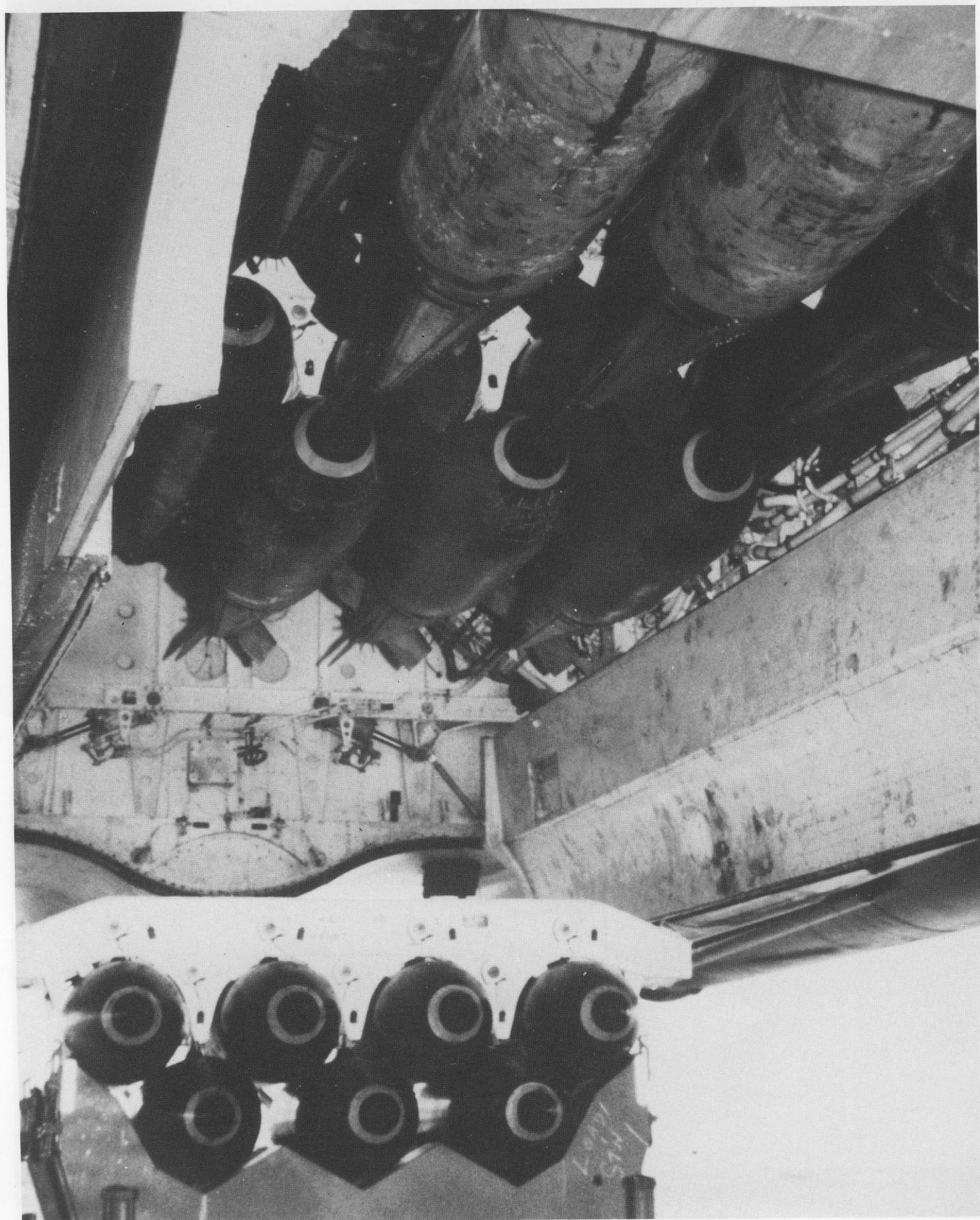


# WEAPONS & STORES

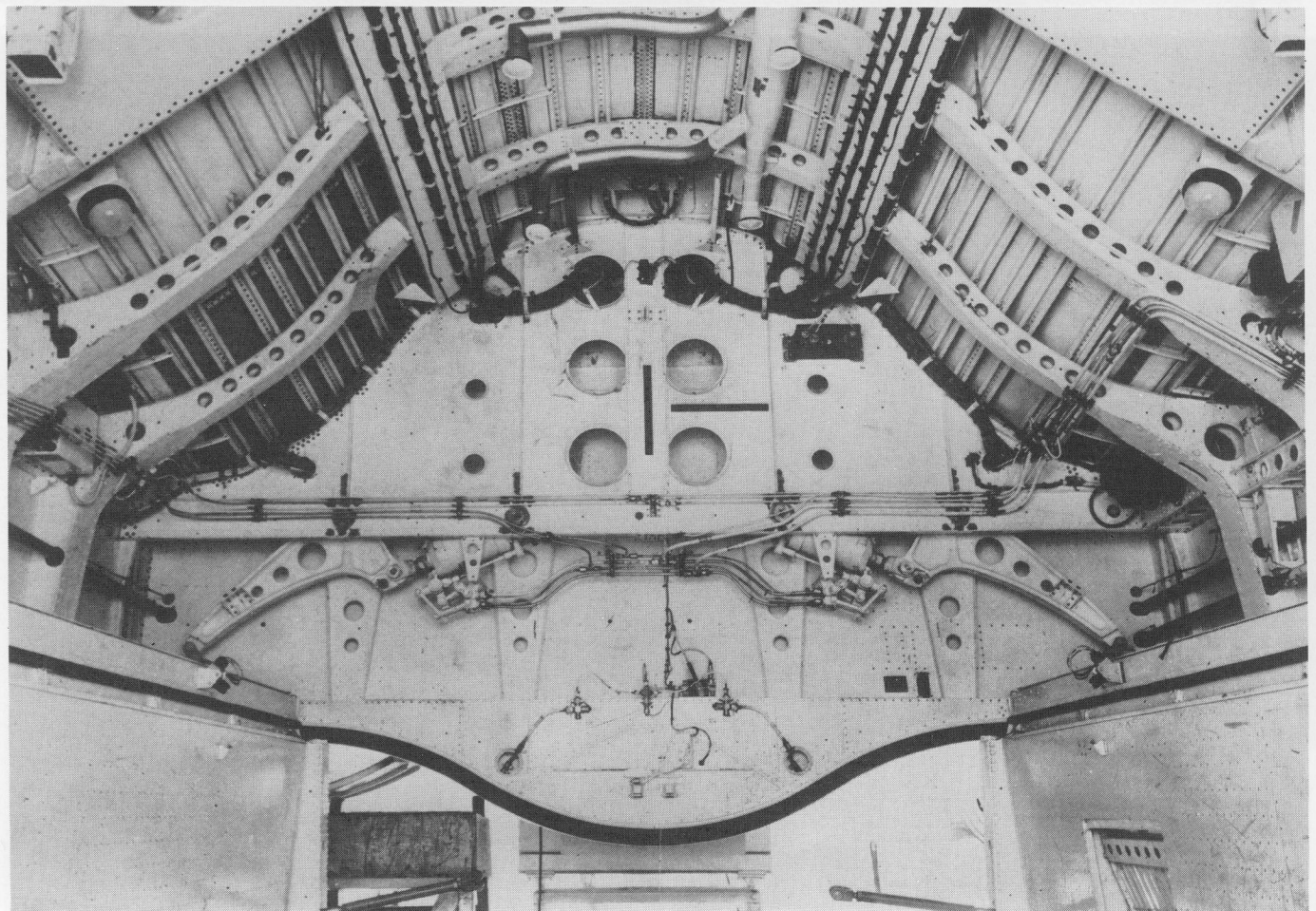
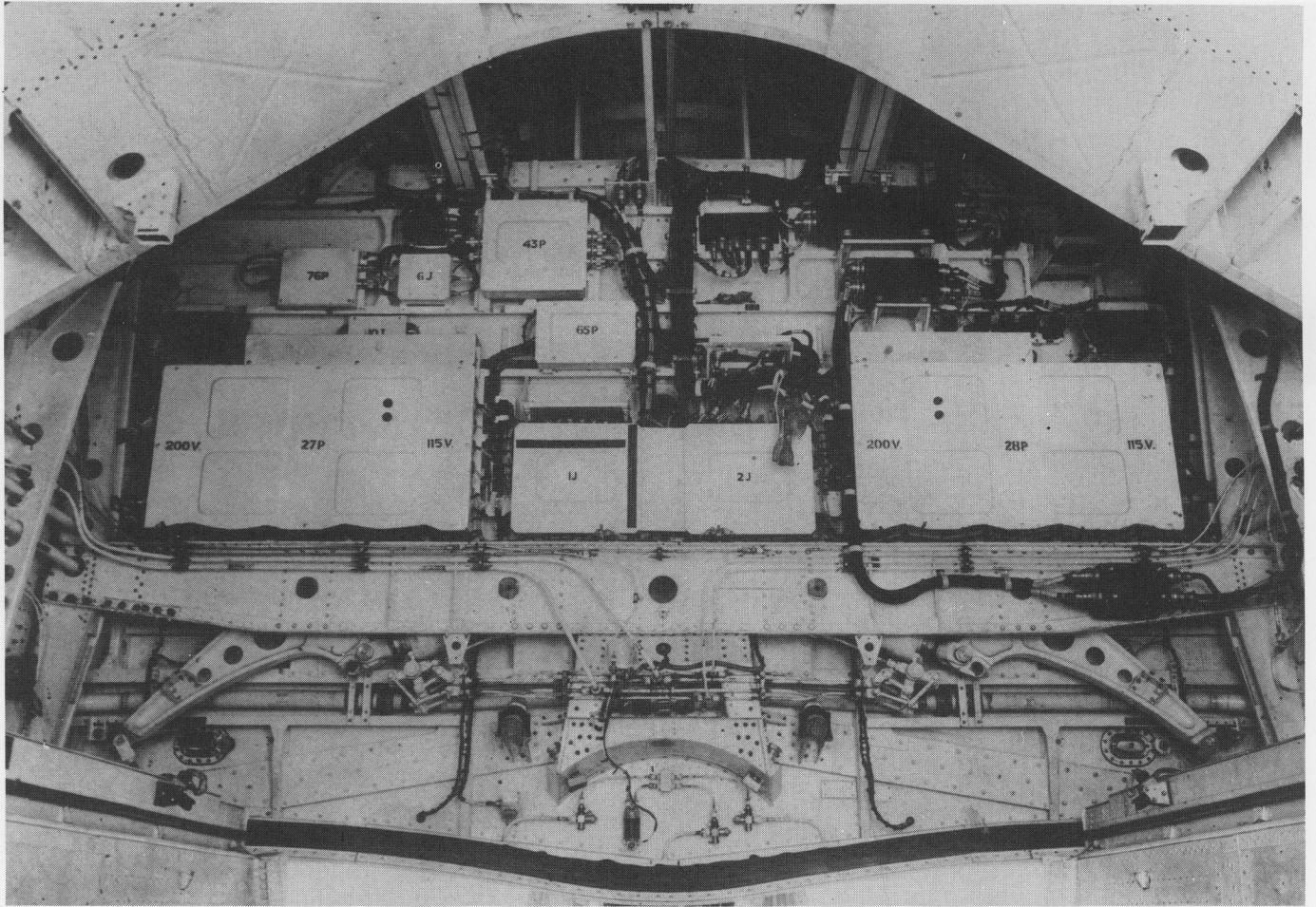
**Below:** Although designed for the nuclear role, the Vulcan could be readily equipped to carry conventional weapons. The standard load was twenty-one 1000lb bombs, arranged in

racks of seven, as shown. Colours here are semi-gloss black and light olive, with deep yellow nose rings. *Ft Lt Mike Jenvey via Bob Downey*  
**Opposite page top:** Forward bulkhead

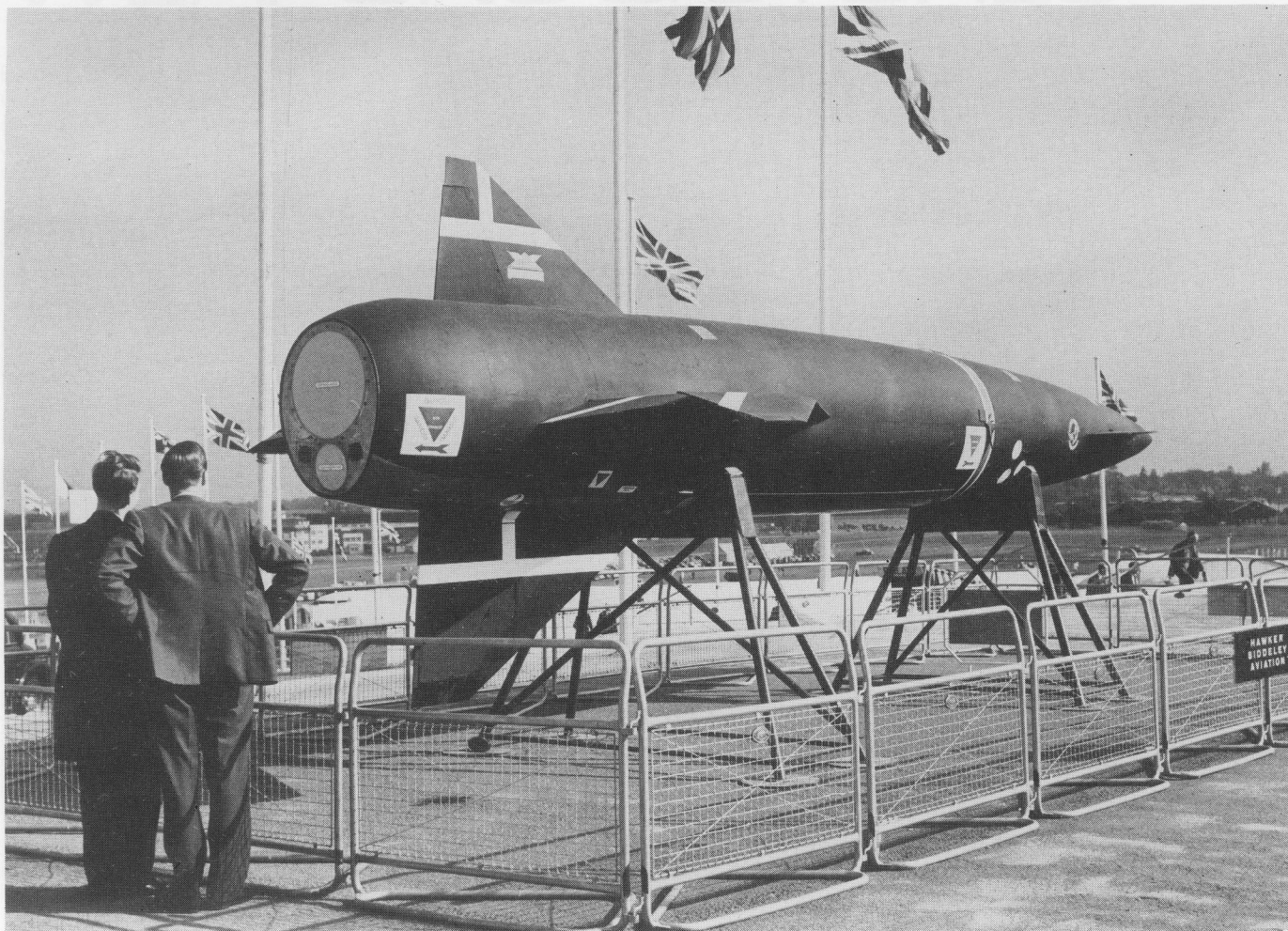
of bomb bay. *British Aerospace*  
**Opposite page bottom:** B Mk 2 rear bomb bay bulkhead. In contrast to the photograph on page 26, the bomb doors are fully extended. *British Aerospace*



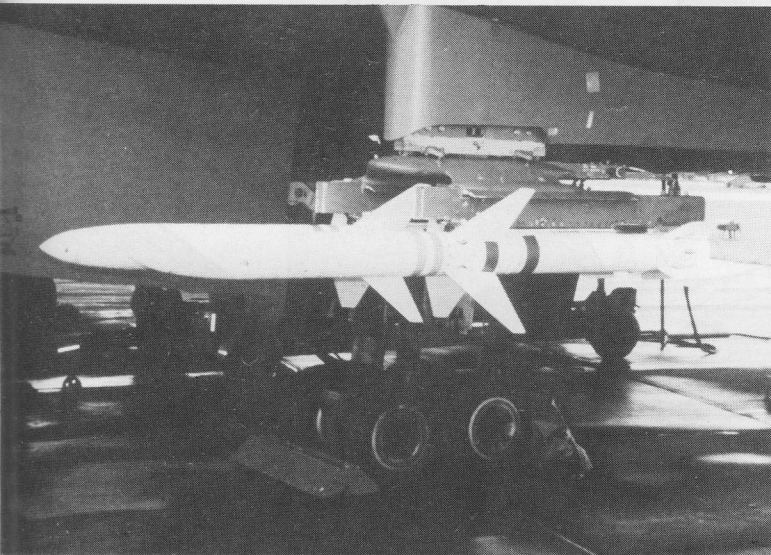
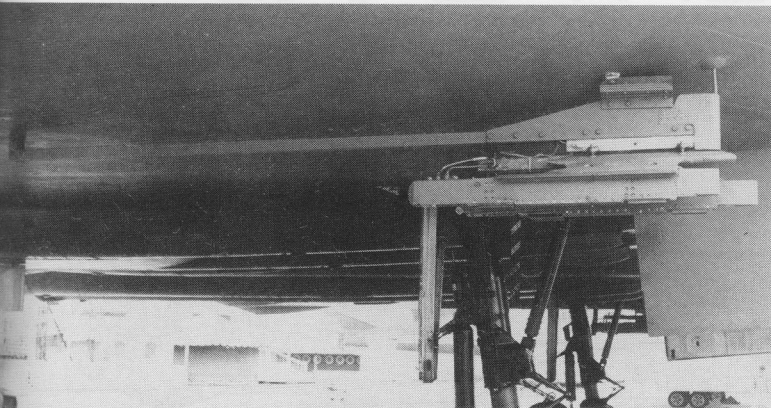












**Opposite page top:** The Avro Blue Steel stand-off air-to-ground missile was the successor weapon to the free-fall nuclear bombs carried by early Vulcans. It was powered by a dual-chamber Bristol Siddeley Stentor rocket motor producing a total thrust of 20,000lb and capable of sending the missile to its target at more than twice the speed of sound. *British Aerospace*

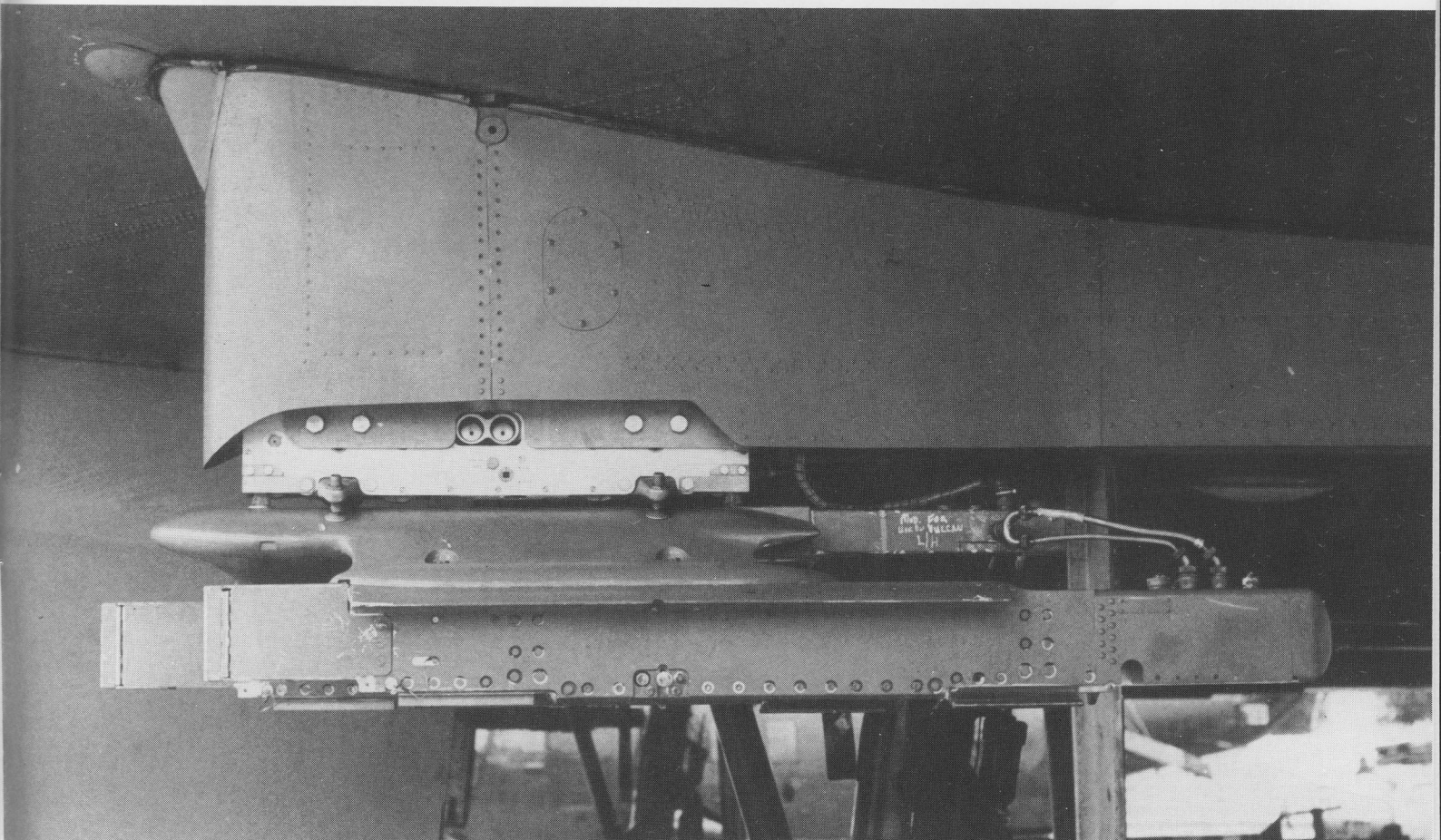
**Opposite page bottom:** The US-designed Douglas Skybolt, carried by Vulcans, was envisaged as the equipment that would provide the British nuclear deterrent during the late 1960s and 1970s. Trials were conducted, but in the event Polaris was bought. *British Aerospace*

**Above left:** Shrike anti-radiation missiles were used by Vulcans during the 1982 Falklands conflict. This is an unfaired pylon and twin launcher. *Bob Downey*

**Above:** Twin Shrike pylon and launcher, port wing of XM597, July 1982. *Bob Downey*

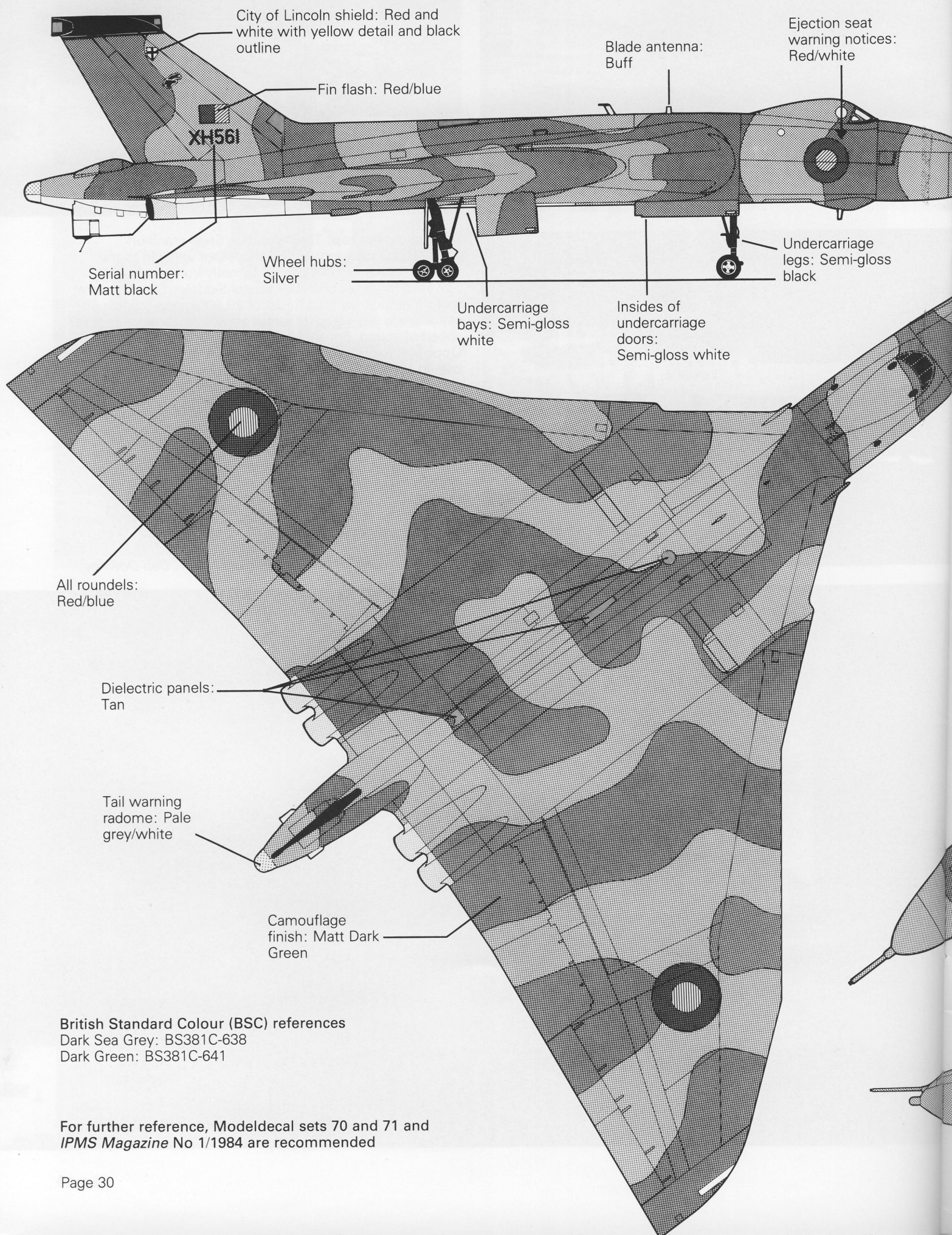
**Left:** Shrikes were white overall, with light blue (front), yellow and two brown bands. *Flt Lt Mike Jenvey via Bob Downey*

**Below:** Close-up of port Shrike rail, XM597. *Bob Downey*





# SCALE COLOUR PLANS



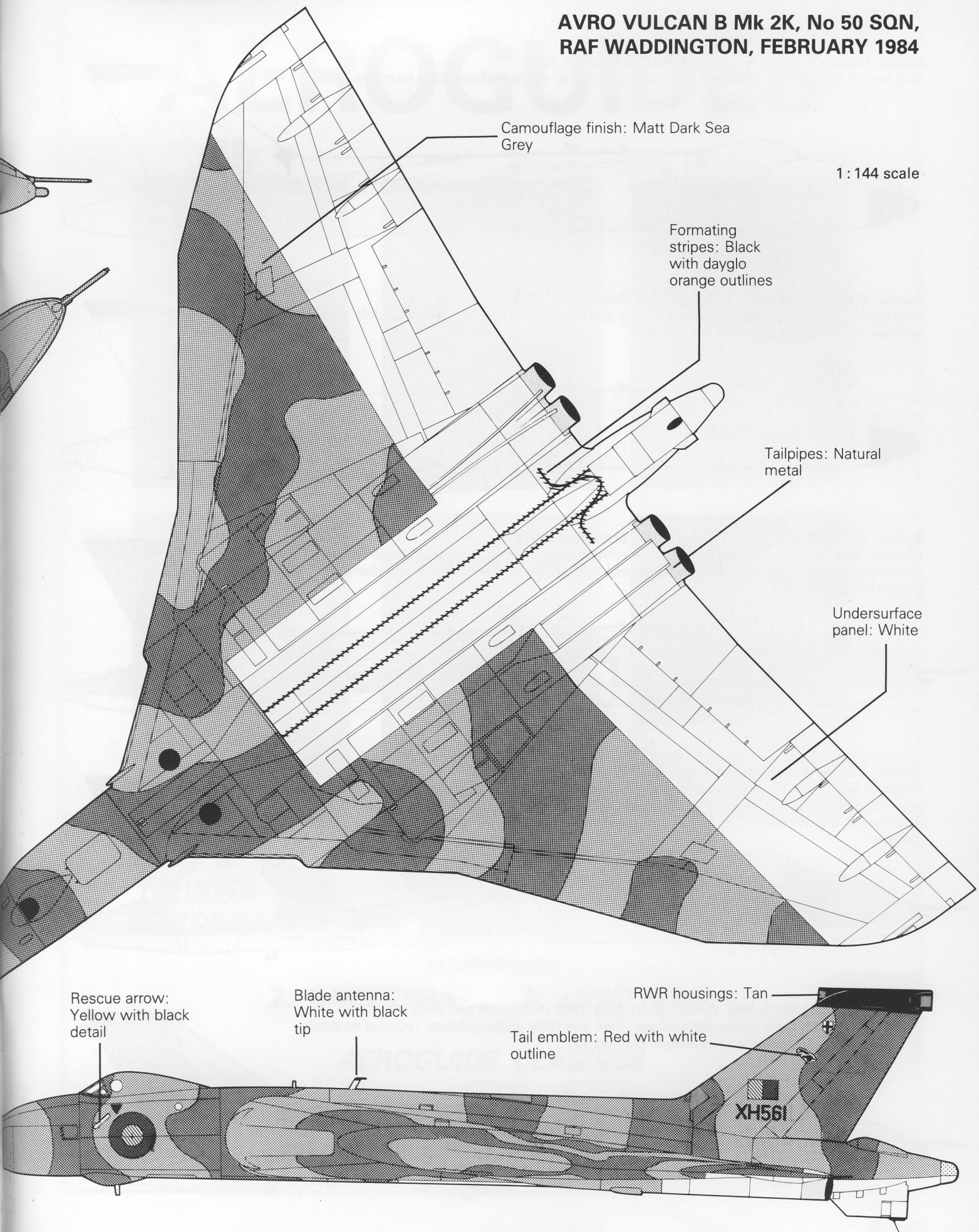
**British Standard Colour (BSC) references**  
 Dark Sea Grey: BS381C-638  
 Dark Green: BS381C-641

For further reference, Modeldecals sets 70 and 71 and  
*IPMS Magazine* No 1/1984 are recommended



**AVRO VULCAN B Mk 2K, No 50 SQN,  
RAF WADDINGTON, FEBRUARY 1984**

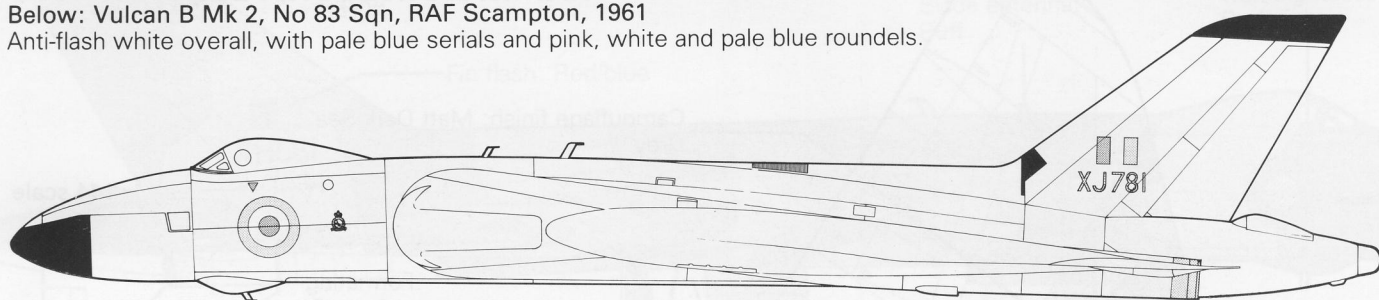
1 : 144 scale





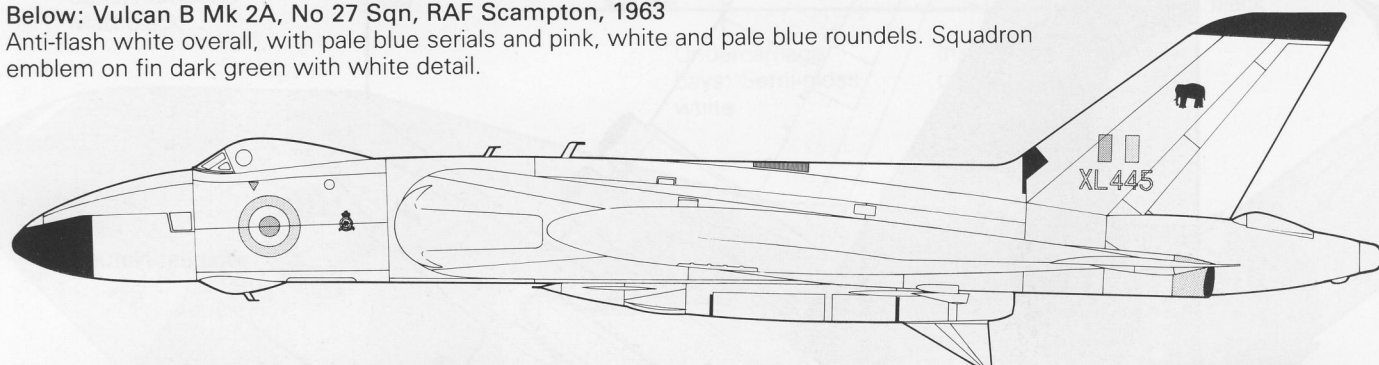
**Below: Vulcan B Mk 2, No 83 Sqn, RAF Scampton, 1961**

Anti-flash white overall, with pale blue serials and pink, white and pale blue roundels.



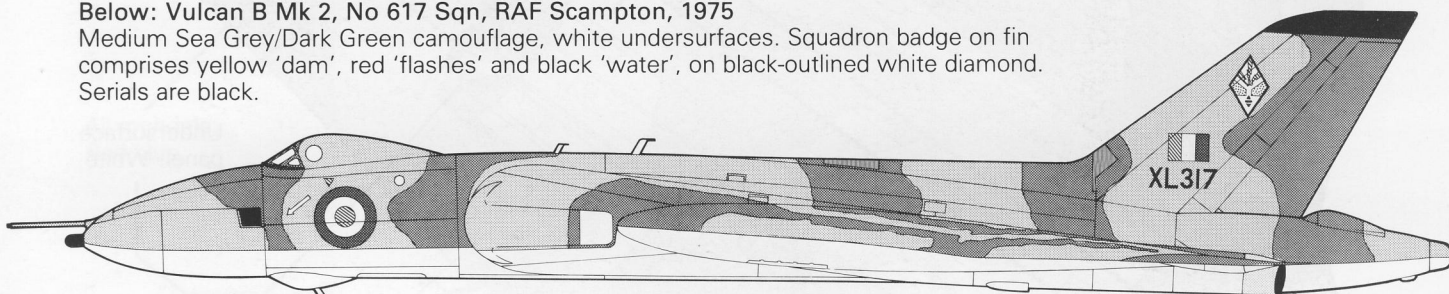
**Below: Vulcan B Mk 2A, No 27 Sqn, RAF Scampton, 1963**

Anti-flash white overall, with pale blue serials and pink, white and pale blue roundels. Squadron emblem on fin dark green with white detail.



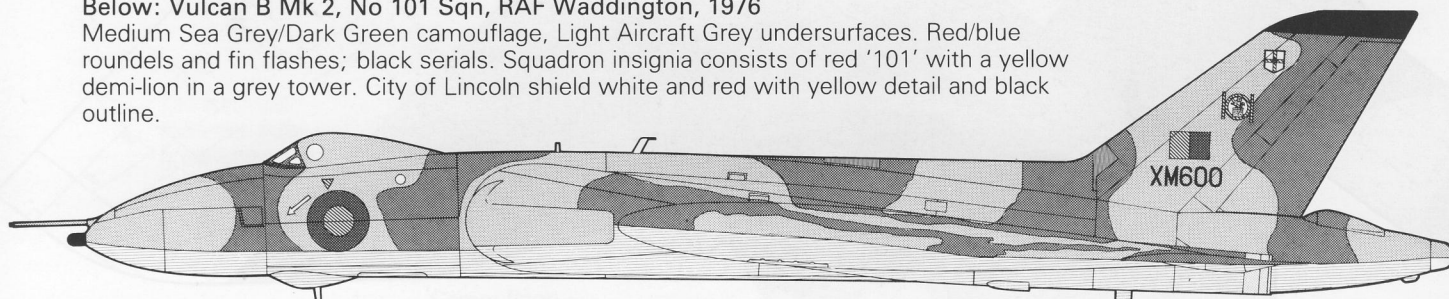
**Below: Vulcan B Mk 2, No 617 Sqn, RAF Scampton, 1975**

Medium Sea Grey/Dark Green camouflage, white undersurfaces. Squadron badge on fin comprises yellow 'dam', red 'flashes' and black 'water', on black-outlined white diamond. Serials are black.



**Below: Vulcan B Mk 2, No 101 Sqn, RAF Waddington, 1976**

Medium Sea Grey/Dark Green camouflage, Light Aircraft Grey undersurfaces. Red/blue roundels and fin flashes; black serials. Squadron insignia consists of red '101' with a yellow demi-lion in a grey tower. City of Lincoln shield white and red with yellow detail and black outline.



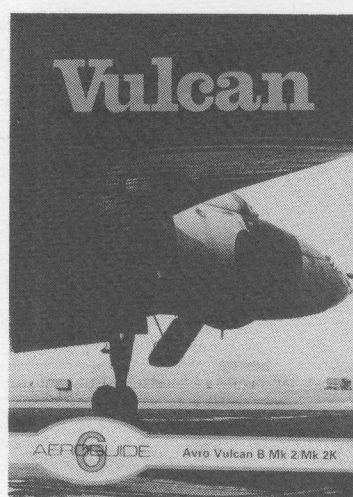
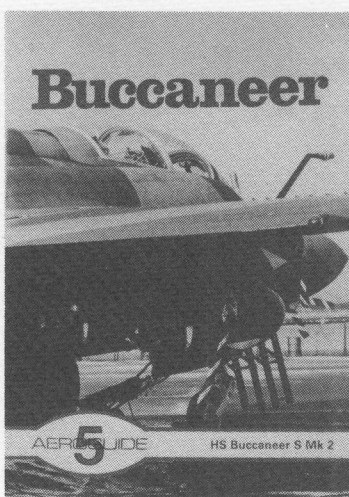
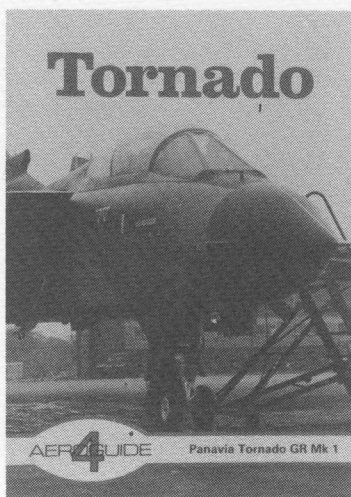
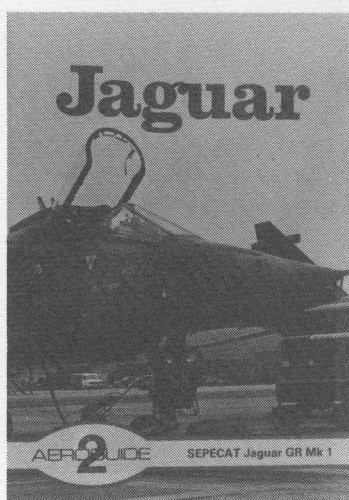
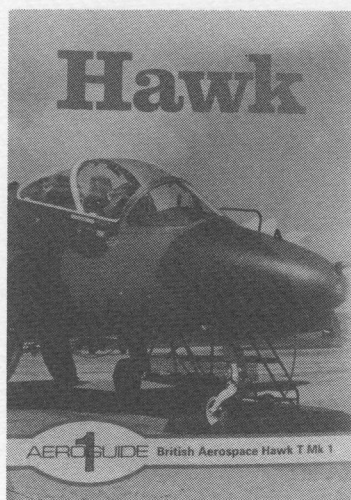
**Below: Vulcan B Mk 2, RAF Waddington, May 1982 (Falklands campaign)**

Medium Sea Grey/Dark Green camouflage, Dark Sea Grey undersurfaces; red/blue roundels and fin flashes, black serials. Fin badges painted out.





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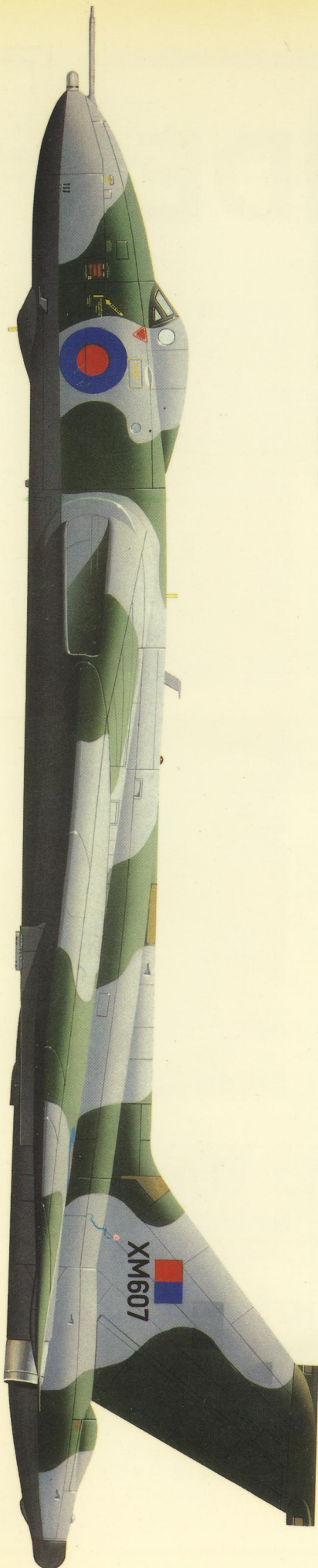


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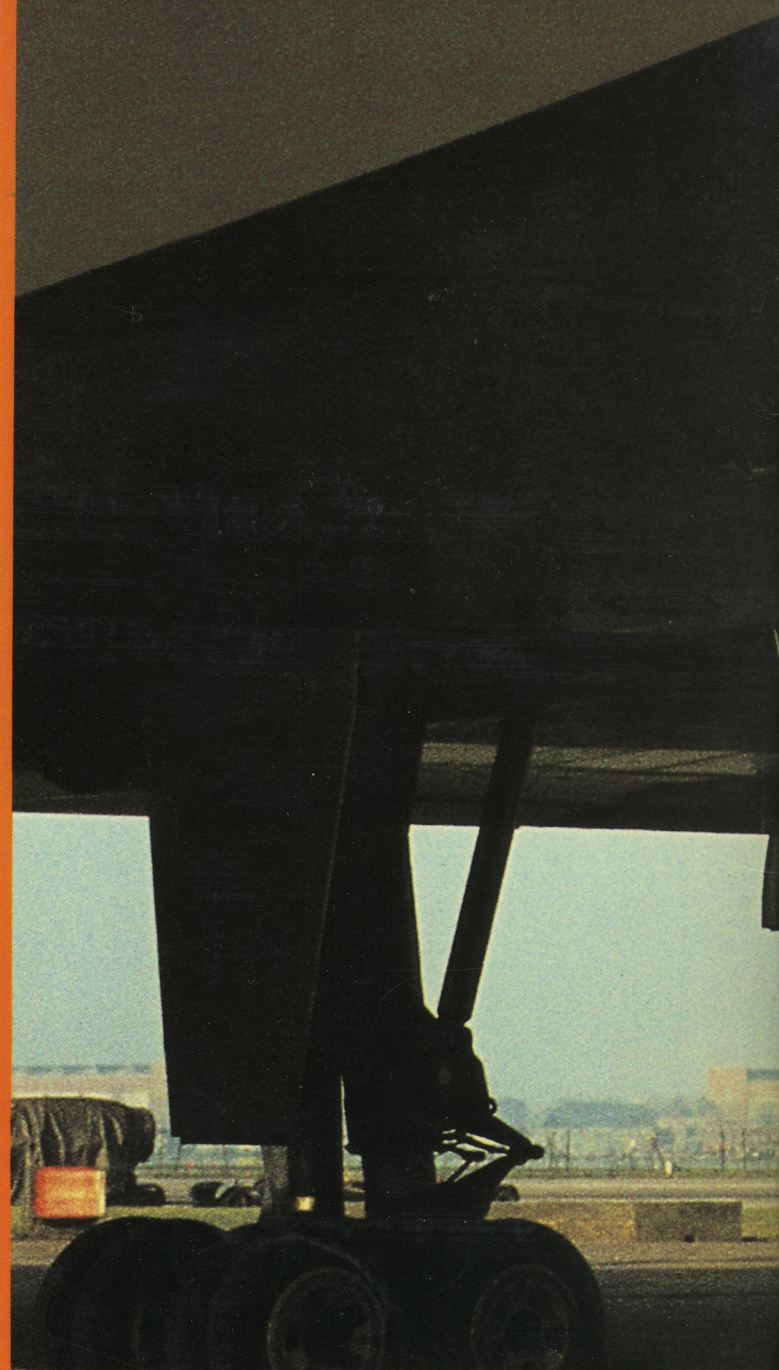


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# Avro Vulcan B Mk 2



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